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February 35c

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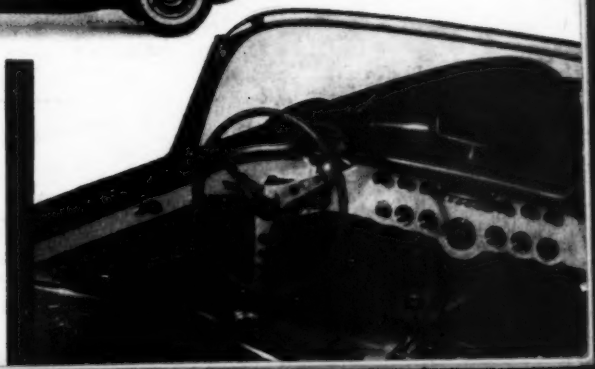

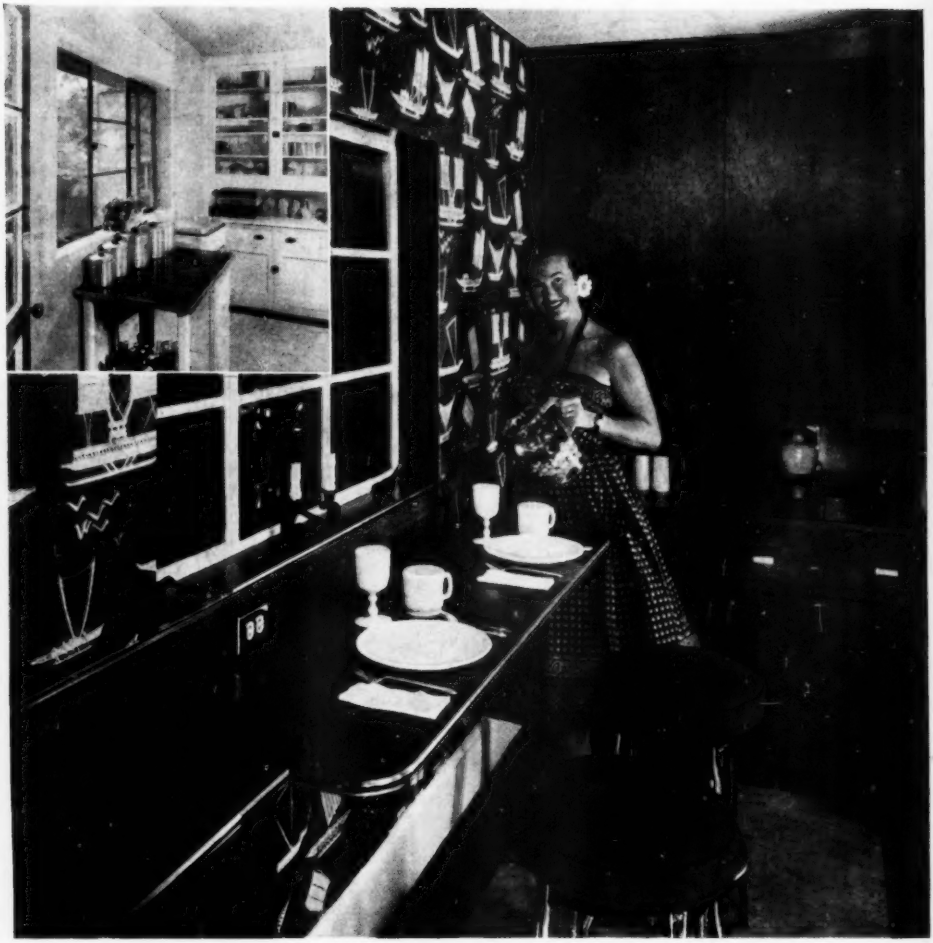

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INVENTORS

If you believe that you have an invention, you should find out how to protect it. The first step is to have a search made of the prior pertinent U. S. patents. If a report on this search indicates that the invention appears patentable you can apply for a patent, and the specifications and claims should be prepared.

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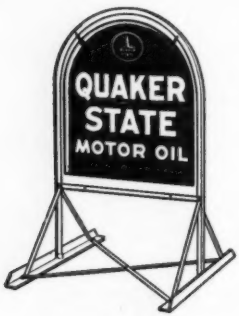

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Letters

Give Back Those Gauges

Phil McCafferty is so right! I, too, want the gauges Detroit left out [Nov., p. 214]. Those Christmas-tree lights that the new cars have in place of real instruments may be okay for Neanderthal drivers who can't read an ammeter anyway. But I like to know what's going on under the hood.

Take oil pressure. The red light won't blink until pressure falls to around 18 pounds. Why, you could lose a bearing at 19 pounds on a hot Sunday drive down here! And there would be nothing to warn of impending disaster until you heard that awful sound of metal chomping metal.

The same is true of the generator telltale. It won't warn of a discharging battery, but only of a failing generator. You could drive all the way to Dallas on a dead battery without getting that light to glow.

R. J. FRANKS, Houston

Anybody have a kind word for warning lights? PSM will award two $25 U.S. Savings Bonds—one for the best letter for, one for the best letter against, the use of telltales in place of conventional gauges. Letters must be received by February 29 to qualify.

Aluminum Bolts for Antennas

In Mr. Mandl's very interesting article "Is Your TV Antenna Worn Out?" [Nov., p. 224], he states, "Rusted bolts should be replaced with galvanized or copper ones." Inasmuch as a good many TV antennas are made of aluminum, I strongly suggest that aluminum bolts, which are available in most hardware stores, be recommended, rather than copper. Copper in direct contact with alumi-

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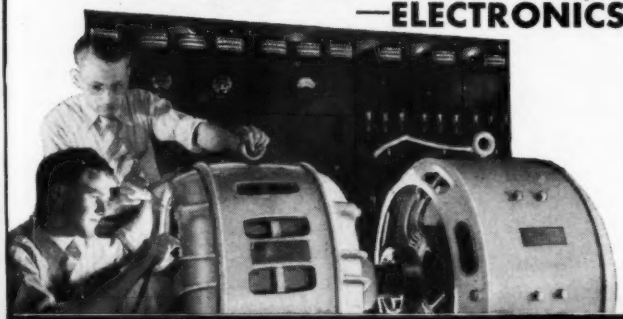

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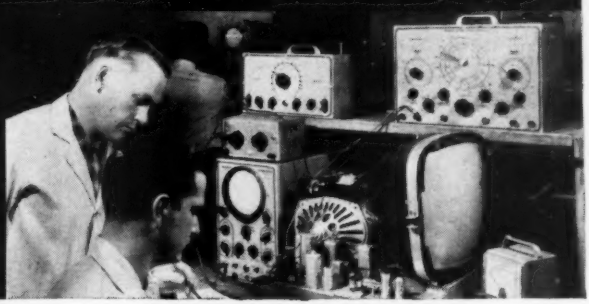
RECEIVING SETS
Including Color TV
AM and FM RADIO
RECEIVERS including
AUTO RADIOS
TELEVISION TEST
EQUIPMENT

(Right — Instructor helping students check the wiring and trace circuits of television receivers.)



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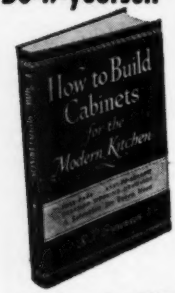

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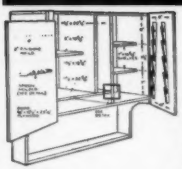

By ROBT. P. STEVENSON
Asst. Managing Editor, Popular Science

TELLS YOU HOW TO BUILD: Over-Refrigerator Cabinet, Over-the-Range Cabinet, Sliding-Door Cabinet, Adjustable Shelf Cabinet, Mix-Center Wall Cabinet, Over-the-Sink Cabinet, Wall Vegetable Bin, Tool Hanging Cabinet, Swing-Shelf Cabinet, Combination Sink Cabinet, Tray and Bread Cabinet, Platter Cabinet, Laundry Hamper, Screen-Bottom Vegetable Drawers, Pop-Up Mixer Shelf, Beside-the-Range Towel Rack, Rolling Vegetable Bin, Sink Pull-Out Racks, Revolving Wall Cabinet, Lifting-Counter Cabinet, Pass-Through Serving Center, Canned Goods Storage Cabinet, Storage Wall, Folding Wall Table, Under-the-Counter Table, Curved-Seat Breakfast Nook, Snack Bar, Kitchen Desk, AND MUCH, MUCH MORE! FULLY ILLUSTRATED.

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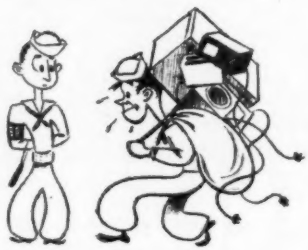
num is not desirable. Galvanized bolts are an acceptable alternate for aluminum bolts in contact with aluminum.

F.F. DIETSCH, Project Director
Reynolds Metals Co., Louisville

Good point. Direct contact between different metals should always be avoided. It causes rapid corrosion.

His Appliances Will Work Abroad

I am in the Navy and am being transferred to a place overseas where the electrical power is 110 volts, but 50 cycles. Will my 60-cycle appliances—an automatic washing machine,



radio, toaster, freezer and all the rest—work over there?

I will give you my new address as soon as possible because I do not want to miss an issue of PSM. I am pretty sure that, abroad, I will find the magazine more useful than ever, both from the standpoint of things to do and, also, to sort of keep in touch with things back home.

FRANK R. FOUST, Phot., USN
Washington, D.C.

Thanks for the kind words. All your American-made appliances—except an electric clock—will work on 50 cycles. But the washing machine may heat up.

How to Scale Up a Drawing

I would like to build that handsome side chair ("How to Build Good Furniture," Nov., p. 178), but I am at a loss as to the detailed measurements for the parts. True, there is a scaled layout, but that's all. How do you follow such a drawing and still come up with good workmanship?

ROY CURRY, Manhattan Beach, Calif.

You enlarge the scale drawing into a full-size pattern. Then you can take any measurements that you want off the pattern—by counting the squares on which it is drawn, or by using a rule or dividers. Here's how to

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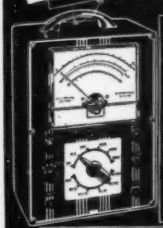

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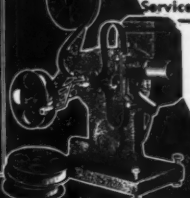

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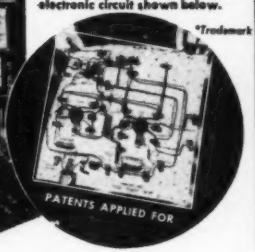
ELECTRO-LAB*

Insert pictorial diagram on transparent styrene base. (See insert.) Mount parts to follow pattern—using handy "snap in" fasteners. Eliminates wiring errors. Tops for speedy circuit changes... for providing maximum circuit experience in minimum time. Build and operate scores of interesting projects — such as the electronic circuit shown below.

*Trademark



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I would like complete facts including "89 Ways to Earn Money in Television-Radio-Electronics."

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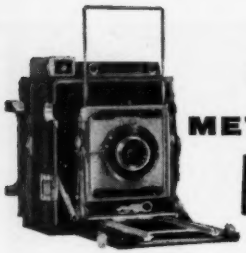
(PLEASE PRINT)

Street _____ Apt. _____

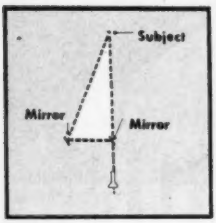
City _____ Zone _____ State _____

1 D.T.I.'s training is available in Canada.

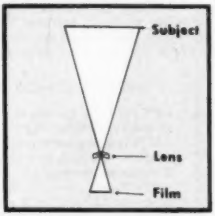


WHY 3 METHODS OF Focusing WITH THE GRAPHIC® 45?

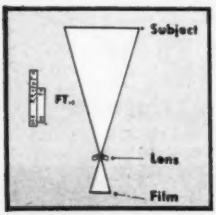
Three focusing methods are featured in the Pacemaker Graphic 45—one of many reasons why it is the most popular, most used all-purpose hand camera on the market. Let's examine these methods one by one.



1. Coupled Rangefinder Focusing with the new Graphic Rangefinder for normal eye level shooting—fastest method for all-around use. Interchangeable cams couple it to wide angle, normal or telephoto lenses. As you turn the focusing knobs on the camera bed, the two images seen through the Graphic Rangefinder window gradually merge until at the point of accurate focus of the lens, both images are superimposed, clear and bright. Built-in Rangelite for night focusing.



2. Ground Glass Focusing is the original and basic method of determining sharpest focus and subject matter to be included in the finished picture. It enables you to see: a) your picture exactly as it will appear in the print; b) what parts of your picture are in or out of focus; c) how you can improve framing or composition. Ground glass focusing is a "*must*" for the serious photographer.



3. Scale or "Guess" Focusing for quick "off the cuff" shooting—convenient for sports, action or ordinary snap shooting. You simply focus the lens with the focusing knobs on the front of the camera bed until the focusing scales on the bed indicate the estimated distance from the subject to the camera.

For the full story on Pacemaker Graphic 45's, write Dept. PS-20, Graflex, Inc., Rochester 8, N. Y.

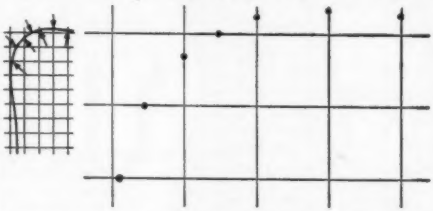
GRAFLEX
Prize-Winning Cameras

scale up a small drawing into a full-size pattern:

First, rule one-inch squares on a sheet

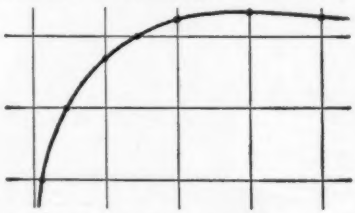
of wrapping paper at least 36 by 40 inches. Or buy graph paper printed with one-inch squares in a stationery store.

On the small drawing, note where the outline of each part crosses the small squares. On your big ruled paper, copy these inter-



sections into the corresponding squares. You will have something that looks like a child's "connect-the-dots" game.

Connect the marks on your sheet with



smooth, flowing lines. Copy exactly the shape shown in each square of the small drawing. That makes your full-scale pattern.

Warm Brick Comforts Pup

Your suggestion for keeping a homesick pup quiet by giving him an alarm clock may be a good one [July, p. 184], but I use a common brick warmed in the oven and wrapped in a blanket. It does the trick.

W. C. Fox, Nampa, Idaho

P. S. If you ever discontinue the Gus Wilson stories I will not know where to start reading your magazine. I always start with Gus.

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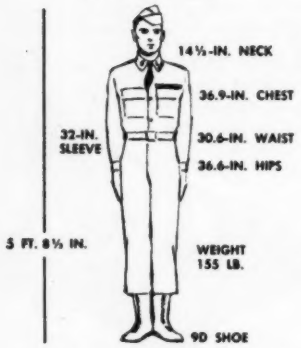
POPULAR SCIENCE MONTHLY

LATE NEWS...

The cancer fighters are winning battles, if not yet the war. First trials of a new blood test showed it to be amazingly accurate at detecting early stages of cancer. A good cancer test would be very valuable, since cancer can usually be cured if recognized soon enough. And some headway is being made against leukemia, the tragic blood cancer that often strikes children. By using cortisone combined with mercaptopurine, doctors at New York's Memorial Center have kept 47 percent of young leukemia patients alive for a year or more. Untreated, only five percent of the leukemia sufferers could be expected to survive the year.

AVERAGE GI A SIZE 38



AVERAGE MEASUREMENTS OF U.S. SOLDIERS FROM ARMY QUARTERMASTER CORPS

Don't argue with radar cops. Their device measures automobile speeds very accurately. When it does err, it usually errs in favor of the speeder, according to a study made for the Buffalo, N.Y., Traffic Department.

The Russians are building what will probably be the world's biggest atom smasher—a 10-billion-volt synchrotron. (The biggest U.S. machine is the University of California's Bevatron—six billion volts.) To run an atom smasher of this size, 140,000 kilowatts of electricity will be required. That's the total output of a big city power plant.

Fourteen-inch tires, one inch smaller than the present ones, are in the works for '57. Goodyear says that its small tires will be fatter than the 15-inchers, and will carry 20 pounds of air pressure.

Latins to get A-power. Orders for three atomic-power plants are being placed by American & Foreign Power, operator of utilities in 11 Latin American countries. Each plant will generate 10,000 kilowatts.

Hormones save teeth, at least in animals. Dr. Irving Glickman of Tufts University reported that injections of the female sex hormone, estrogen, into animals with pyorrhea reconstructed jawbone tissue, preventing loss of teeth.

Navy plans giant A-sub. Twin atomic engines will power the Navy's biggest submarine. Its speed – over 30 knots – will match the fastest surface ship.

New building materials are in prospect for American homes. Among those expected soon:

- Concrete boards—wood excelsior combined with Portland cement. They unite the qualities of both materials.
- Wood bricks, made from short sawmill leftovers.
- Insulation six inches thick, to shield air-conditioned homes from attic heat.

Adjustable power steering is available on a new British car, the Armstrong-Siddeley Sapphire. You can turn it up for parking and traffic, then cut down on the power assist for highway driving.

Good book. Model T fans will have a grand time with *Tin Lizzie*, by Philip Van Doren Stern (Simon & Schuster, $3.95). Besides facts, jokes, even songs about the most famous car ever made, it describes the Flivver that PSM restored.

The secret of Pontiac's *blazing go* is in the teamwork of *two* engineering masterpieces . . . the mighty Strato-Streak V-8 . . . and the revolutionary new Strato-Flight Hydra-Matic*!

It's the sort of power and go you dream about. But this time it's real.

Behind the wheel of the flashing '56 Pontiac you command an engine virtually alive with spirit . . . and a terrific urge to be on the move. A cubic displacement of 316.6 inches gives you terrific take-off! A whopping big 8.9 to 1 compression ratio squeezes the last ounce of *go* out of every drop of gas. *That's power* . . . blazing 227 *horsepower!*

You purr along peacefully, completely unaware of the other half of Pontiac's great power team . . . the fluid-smooth Strato-Flight Hydra-Matic. There's perfect harmony here (it was carefully engineered that way) . . . for this great new automatic transmission takes the tremendous thrust from the engine and utilizes every ounce of it, passing it on, smooth as silk, to the rear wheels. An amazing new controlled fluid coupling combined with the efficiency of gears does the trick!

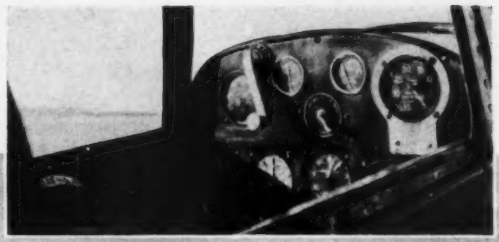
Test the flashing new '56 Pontiac yourself. But hold on to your hat, you'll be piloting the greatest "go team" on wheels.

**An extra cost option.*

PONTIAC says GO

and the price won't stop you!

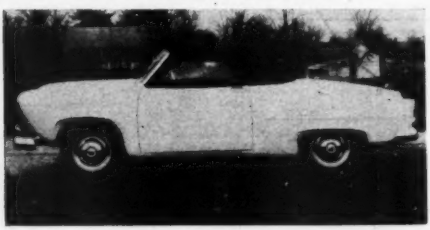
CRAFTSMEN AT WORK



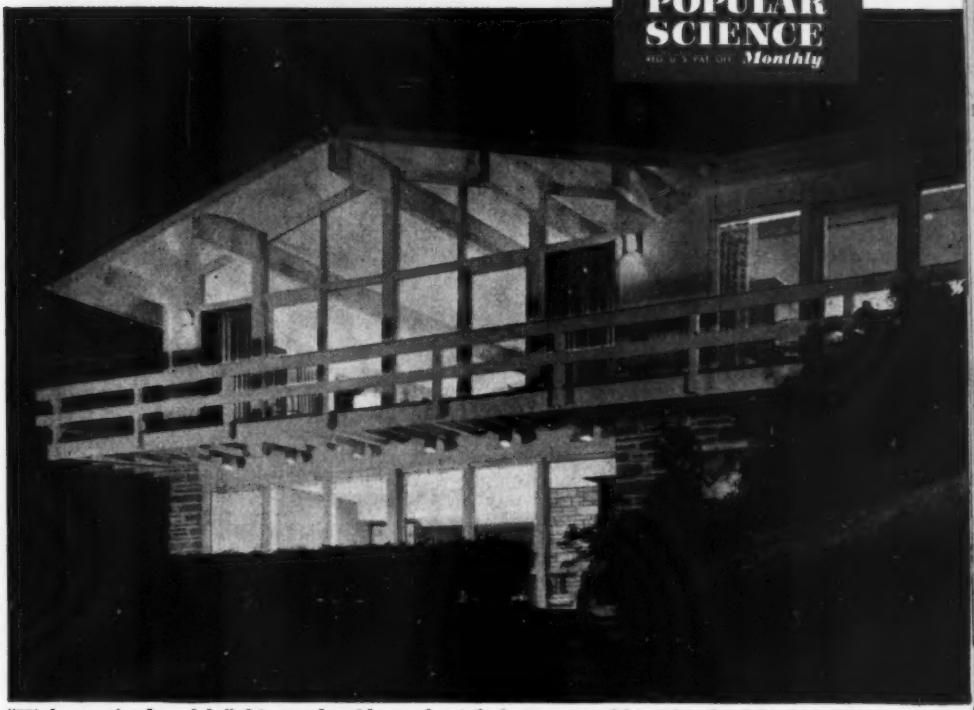
Homemade Plane. Fred Clifton and sons Gene and Jack put in two years of spare time and $800 building this 625-pound aerial hot rod in the family garage at La Junta, Colo. The single-place monoplane cruises at 160 m.p.h., can hit 180. An 85-hp. Continental engine that cost $325 spins the $125 variable-pitch propeller. About $100 worth of steel tubing went into the 17½-foot fuselage. The fabric took $75, the factory-rebuilt instruments $50. The standard landing gear was salvaged from a wreck.

Tin-Can Artist. When a teacher in the U.S. sector of Berlin challenged his handicraft class to create toys from scrap, the student at left turned out two unusual ones from empty cans and boxes. Wire, cord and screws hold the parts together. The motorcycle rider appears to be a working model.

For-J-Let. A Henry J chassis, Ford V-8 engine and overdrive transmission and Chevvy springs and radiator were among the parts that went into the roadster below, christened a For-J-Let. The top is black orlon on a frame from a 1941 Pontiac convertible. The Reverend Wallace Gardner, Rushville, Ind., estimates that he spent more than 900 hours and about $1750 building the car.



POPULAR SCIENCE Monthly



"Highest-priced prefab," this two-level house by Scholz Homes sold in Cleveland for $86,000.

What's new in

Prefab Homes

One in every seven new homes this year will be factory-built. Some are aimed at the Cadillac trade, with $50,000 price tags.

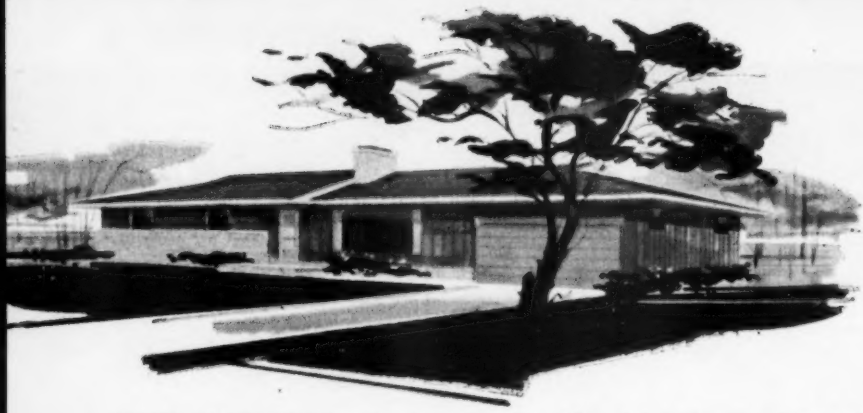
By John L. Springer

MODERN architects will be enthusiastic about the new homes that prefabricators have brought out for this year's customers. They are long and low, with vast expanses of glass. The roofs are flat or pitched only slightly, and have wide overhangs.

Homes built this way a decade or so ago were often said to look "cheap." Now it's smart to have such a home. If you like this contemporary style, you can often obtain a home more reasonably now from a prefabricator than from a conventional builder.

This is not surprising when you consider how prefab homes are built. They usually consist of panels made in a factory so that they can be put together quickly elsewhere. This method turns out one-story homes with low roofs more easily than it does older styles.

The manufacturers have taken pains, however, to see to it that their houses still look like houses, rather than barns or factories. And they have found many new ways of making each house look dis-



MODERN HOMES' "MANOR" has low hip roof with wide overhang, dazzling features like bedside switches to open and close windows. Built on an average-priced lot, it costs about $22,000.

tinctive, so that a row of prefabricated homes no longer needs to look monotonous and dreary.

The first prefab homes were usually about the size of a chicken coop. Now such homes are bigger and roomier. This is a logical development, too, because what most prefabbers actually sell is the shell—outside walls, inside partitions, and roofing. The rest of the things that go into a house—masonry, plumbing, heating, wiring, flooring and painting—are often created at the site, and probably cost as much for a prefab as for a similar house built in the usual way. Hence, the savings of factory assembly have to come from the shell; and the bigger the shell is made, the greater the relative saving.

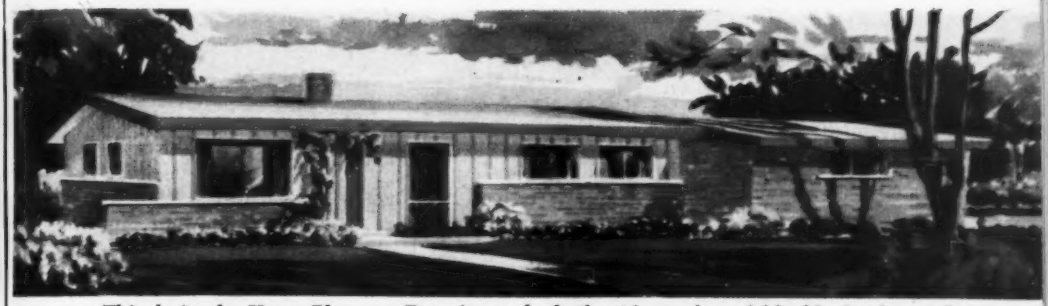
One of the interesting new designs is really a double house. Introduced by W. G. Best Homes of Effingham, Ill., this "Starlyte" model has two separate sections, connected in the middle by a vestibule. One side is for cooking, eating and recreation; the other for sleeping.

In its high-priced Ridgewood luxury line, National Homes has introduced another feature that will probably attract a lot of attention. It is a kitchen squat in the middle of the house, with halls on three sides, and without any windows or doors leading to the outside. A fan with ducts does the ventilating.

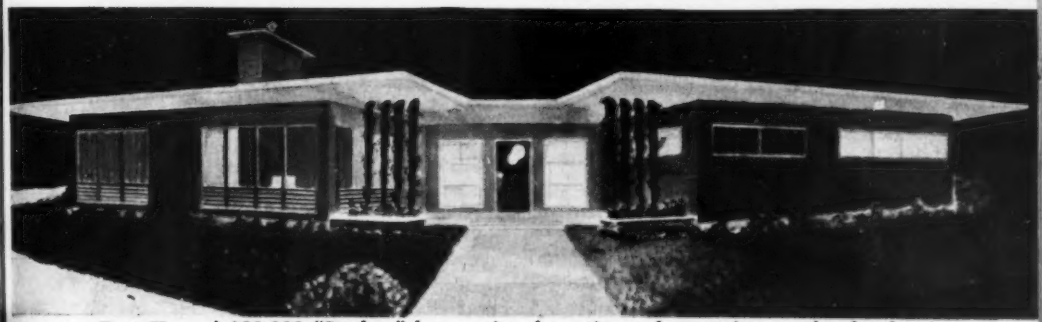
The large manufacturers offer so many models nowadays that you find many different-looking homes when a prefab development is finished, even though all of the homes came off an assembly line.

SCHOOLS TOO—also churches and supermarkets—are now prefabricated. This school, built by National Homes in Lafayette, Ind., was completed 21 days after the foundation was poured.

Pease Homes' "Shorewood" has clean, modern lines. Cost, with luxury extras: about $30,000.



This design by Home Planners, Detroit, can be built with panels prefabbed by lumberyards.



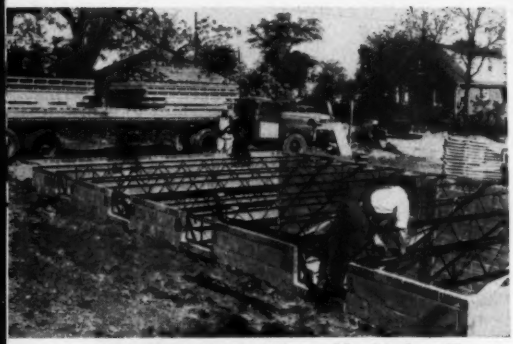
Best Homes' $30,000 "Starlyte" has a wing for eating and recreation, another for sleeping.

U. S. Steel Homes, for example, takes one basic floor plan and offers many variations. One model has a wide window wall, and wide-open planning where the kitchen and dining room open to the living room. Another house with the same square footage has conventional windows, and its kitchen and dining area are closed off. You would think you were in two entirely different houses.

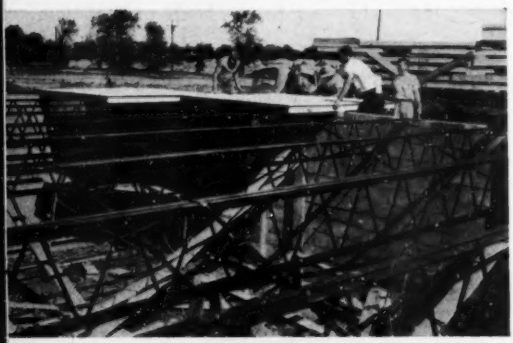
Prefabs used to be synonymous with low price. Most factory-produced houses now sell for around $10,000 or $12,000, but you would not have much trouble finding one price-tagged at $30,000. A Cleveland man who saw a Techbuilt house made to sell for $20,000, souped it up with extras, and wound up paying $60,000 for his prefabricated home.

If you are looking for new ways to cut building costs, however, you can learn a bookful of valuable lessons from

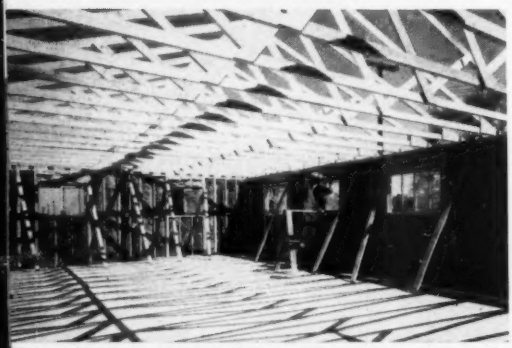
Prefabbers use modern methods to get their houses up fast



STEEL JOIST FRAMING is used by Modern Homes. Joists hang on top of foundation, four feet apart, and span entire width of the house, eliminating lally columns in the basement.



PLYWOOD FLOOR PANELS are often prefabricated at the factory on a framework of two-by-fours and are bolted to steel joists at the site. Users claim that floors built this way are stronger.



ROOF TRUSSES supported entirely on outside walls give prefabbers wide-open interiors to work in. They lay the finished floor and erect ceilings before putting up interior partitions.

prefabbers. They're the experts. Here are some of their cost-cutting ideas that can be applied to conventional houses:

• *Combined sheathing-siding.* The new exterior-grade plywood with vertical grooves, known as "Texture 1-11," serves a double purpose and sharply cuts labor costs. It takes the place of sheathing, building paper and siding.

• *Prefab flue.* By placing the furnace in the center of the house, usually near the kitchen and bathroom, many prefabbers reduce the length of duct runs and hot-water supply lines. This saves material. Flues, hung from the ceiling, go up in two hours, saving about a day's wages.

• *Roof trusses.* First-floor ceiling and roofs are framed together at the factory to span the entire depth of a house. Outside walls carry all the weight of the ceiling and roof. There's no need for load-bearing room partitions. Trusses save lumber, speed erection time and make it possible for you to have wide open spaces inside the house.

• *Inexpensive room dividers.* Instead of erecting a costly, stud-wall partition between the kitchen and the dining area, many prefabbers install a bamboo curtain which runs on a track in the ceiling. This divider can be opened full-width, making both rooms look larger.

• *Double-duty wiring.* You will often find electrical outlets serving different rooms on opposite sides of a wall partition. Attaching two outlets opposite each other to one stud saves wire and labor.

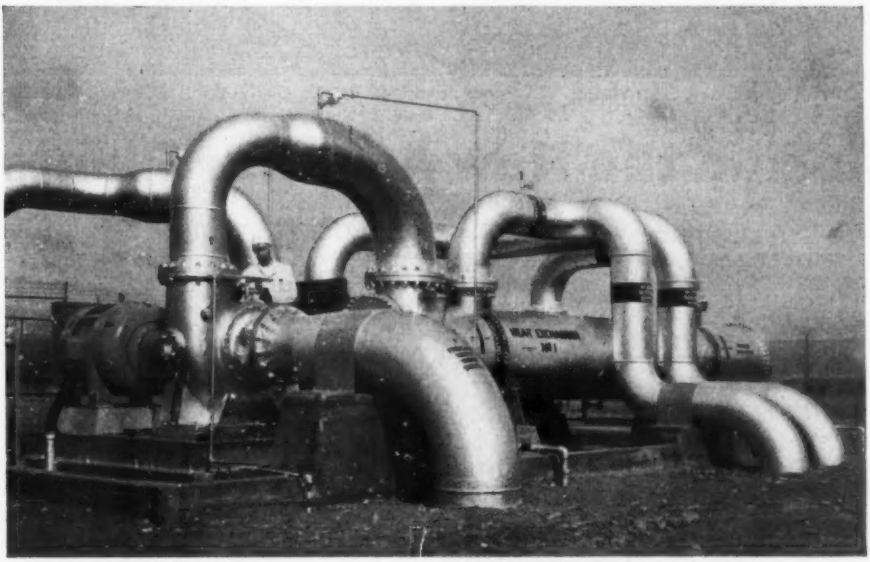
Many obstacles that stalled prefab manufacturing in the past have been knocked out now. In most sections of the country, the building codes now permit you to erect a factory-made home. And it is usually simple now to finance such a home with Government-backed Federal Housing Administration or Veterans Administration mortgages.

Prefabbers admit, however, that they still find it difficult to sell their houses in neighborhoods where "prefabrication" remains a naughty word. Many people remember when nearly all prefabs were square cracker boxes that looked as if

[*Continued on page 268*]

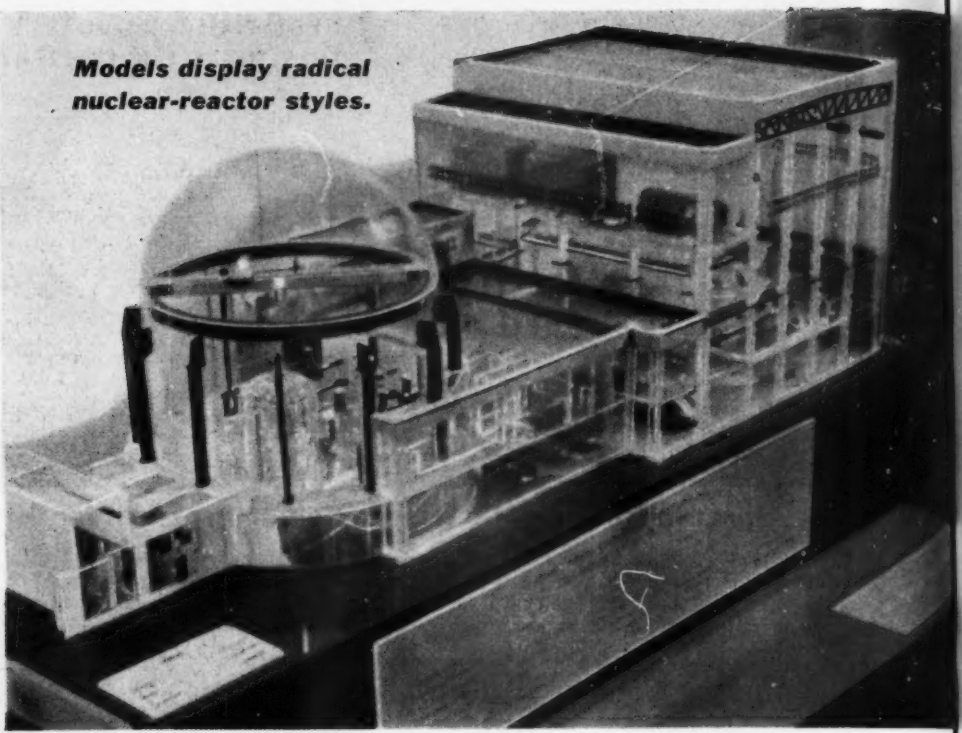
Baby Atom Smasher Will Go Down a Hole to Prospect for Oil

THESE engineers are comparing the world's smallest atom smasher with a standard laboratory model. The baby accelerator will be used to identify and locate oil at great depths by producing a stream of neutrons which penetrate the earth around a well bore. The reactions that are set up by the rays will help oil men to "log" or evaluate wells.



Waste Heat from Reactors Now Air-Conditions Atomic Plant

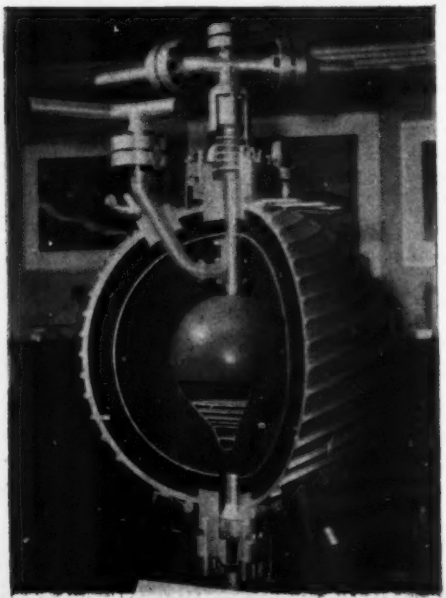
WATER that is used to cool reactors now also warms workers at the Hanford atomic plant. Pumped to a heat exchanger, it gives up its heat to an ethylene glycol solution which transmits it to the plant buildings. GE engineers who devised the system decided on antifreeze as the transfer agent to prevent its freezing in outdoor coils (above).



"Fast breeder" A-power station will have advanced design and 100,000-kilowatt capacity.

Inside the New A-Power Plants

Liquid-fuel reactor pioneers use of thorium.



RECENTLY exhibited models show two of the most promising of a crop of advanced new designs for atomic power plants.

Due for completion in 1959 at Monroe, Mich., the $54,000,000 generating station above will house a "fast breeder" reactor that conserves atomic fuel by creating more than it consumes. A mighty midget using high-speed neutrons, it has a core or "firebox" only three feet in diameter and three feet high, but will whirl a 100,000-kilowatt generator to feed current into Detroit Edison lines.

Centered in the domed reactor building, a circular chamber encloses control rods, which extend downward to the reactor in its sealed underground capsule. Uranium-alloy plates enriched in

U-235 serve as fuel; more fuel is "bred" in a surrounding uranium blanket. Liquid metal carries heat from the reactor to a heat exchanger and thence to a boiler, making steam for the turbogenerator in the oblong powerhouse. Atomic Power Development Associates, Inc., a group of 33 electric, manufacturing and engineering firms, developed the plans.

In the other new design, at the bottom of the opposite page, liquid fuel courses through the pear-shaped zirconium-metal core of a pilot-size Oak Ridge National Laboratory power reactor. Shown by a ¾-actual-size cutaway model, the six-foot globe will yield 5,000 to 10,000 kilowatts of heat energy, of which a small fraction will drive a 300-kilowatt generator in trials. Fuel (symbolized by red) is uranyl-sulfate salt enriched to 90 percent U-235 and dissolved in heavy water. The hollow space surrounding the core (green) will hold thorium oxide suspended in heavy water, and breeding will turn the thorium into fissionable U-233 fuel. Water-cooling tubes form spiral ribs in the surface of the outer stainless-steel globe.

Attractively simple in design, a liquid-fuel reactor has been called "a pot, a pipe and a pump." Spent fuel is reclaimed continuously, instead of in batches. And this type may best exploit abundant thorium for fuel.

These illustrated designs exemplify two parallel plans for U. S. atomic-power development. The Michigan project is part of a Power Demonstration Program undertaken by private industry, with Government encouragement and aid in research, since January 1955. The Oak Ridge reactor is one of five promising types being built meanwhile by the Atomic Energy Commission in the Government's own Civilian Reactor Program, begun in 1954 to advance power-reactor technology. First to produce a full-scale A-power plant will be the Government program, with completion in 1957 of another AEC project, a pressurized-water reactor operating a 60,000-kilowatt atomic powerhouse at Shippingport, Pa. *–Alden P. Armagnac.*

New British Scooters Designed for the Gals

Aluminum motor powers scooter above.

This carlike model has sheet-metal body.

ESPECIALLY for the ladies, the featherweight British scooter in the top picture uses aluminum for all the motor's castings, with hard chrome-plating for the cylinder's wearing surface. A preselector mechanism eases shifting gears, and one handle-bar twist-grip provides control. The same Birmingham maker, B.S.A. Motor Cycles, Ltd., offers another model (lower view) with 50-m.p.h. top speed and carlike features: electric starter, four-cycle engine with coil ignition, four-speed gearbox, twin mufflers and shaft drive. The sheet-metal body flares out in front, shielding the rider from road splatter. The gas tank and the battery are concealed under the hinged dual seat.

You're not seeing the ground but a photo mural decorating an oil company's executive plane.

Plush Planes Tailored

In the plane below, V.I.P.'s can watch TV from a curved divan that turns into a berth.

Flying offices now let company bosses work on the wing amid the comforts of a private club.

FLAGS OF 80 COUNTRIES adorn the nose section of the Chicago *Tribune*'s retailored, widely traveled Convair 340. Galleys on planes like this, fitted with stoves and refrigerators, can make a snack or a banquet.

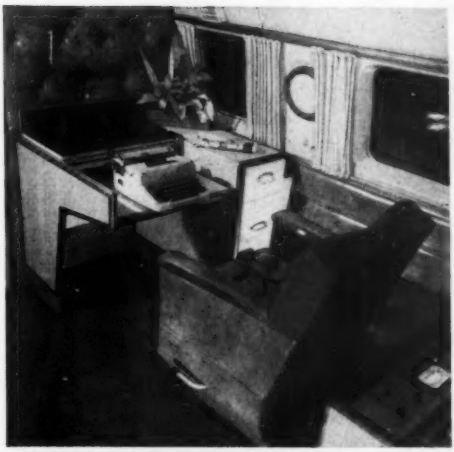
FAR FROM COMBAT missions, a former B-26 done over for a pipeline company is well equipped for comfortable conferences. Those ceiling grilles hide radio speakers. Most executive planes also have air-to-ground radiophones. The planes may cost up to $750,000; interior styling comes to another $100,000 or more, depending on structural changes required.

for Business Brass

A KIND of de luxe tailor shop, where company-owned airliners come for fittings and alterations and leave dressed in the height of luxury and fashion, lies alongside Los Angeles' International Airport.

Of the 21,500 business planes in the U.S. today—15 times as many as the scheduled airlines have—a select and svelte group has been expensively decked out by this shop, the AiResearch Aviation Service Co.

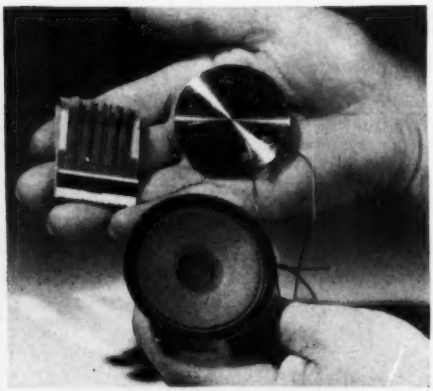
Here you see some fancy interiors that have been turned out to make life aloft more pleasant and efficient for top corporations' top brass. What you don't see are the bigger engines, nylon fuel tanks, pressurization and air-conditioning gear, radar sets, automatic pilots, and powered trim tabs often included.—*Wesley S. Griswold.*



WORKING QUARTERS for a high-pressure executive aloft provide a typewriter fore and a tape recorder aft, with an easy chair that swings around smoothly from one machine to the other, as desired.

Six Jets on 1937 Chevvy Give It High Speed, Short Range

CALLED "The Thing" by its inventor, John Shelburne, a Hannibal, Mo., auto serviceman, this experimental jet car goes so fast that its speedometer can't clock it. On top are six jet engines: twin rear take-off jets burning methyl alcohol, a big gasoline main jet, upper kerosene twins, and another alky job behind them. The odd vehicle uses a lot of fuel.



Tiniest Speaker: Half Inch Thick

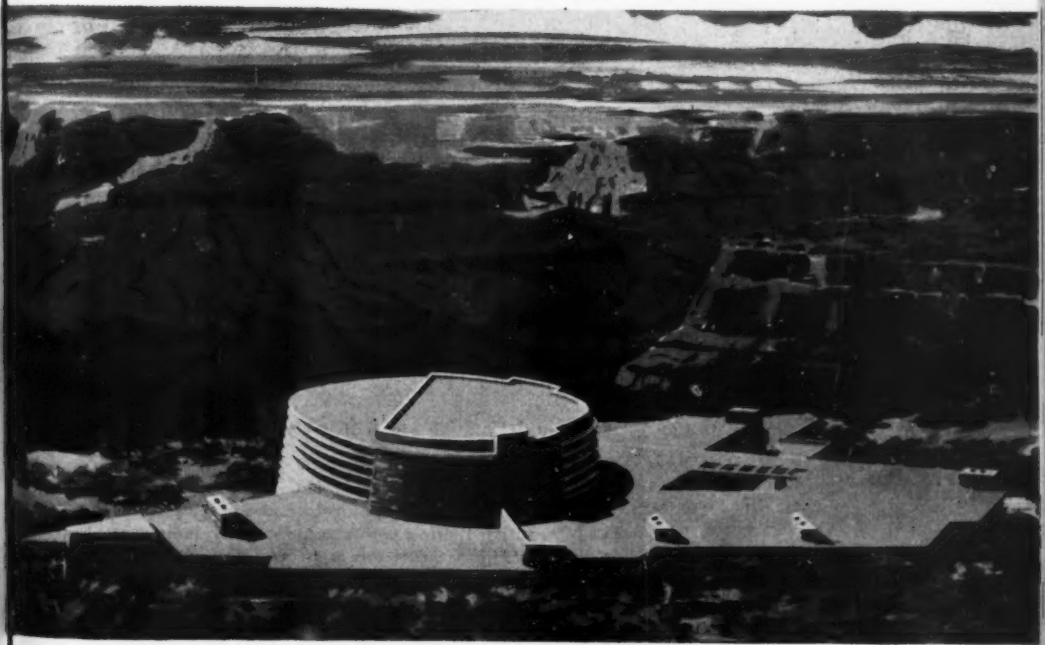
BUILT for transistor pocket radios, the loudspeaker at top above is said by RCA to be the smallest ever built for commercial receivers. Its magnetic structure is housed within the shell around its vibrating cone so that it is only half an inch thick—half the size of the older midget (in foreground) which has the magnet in its housing.

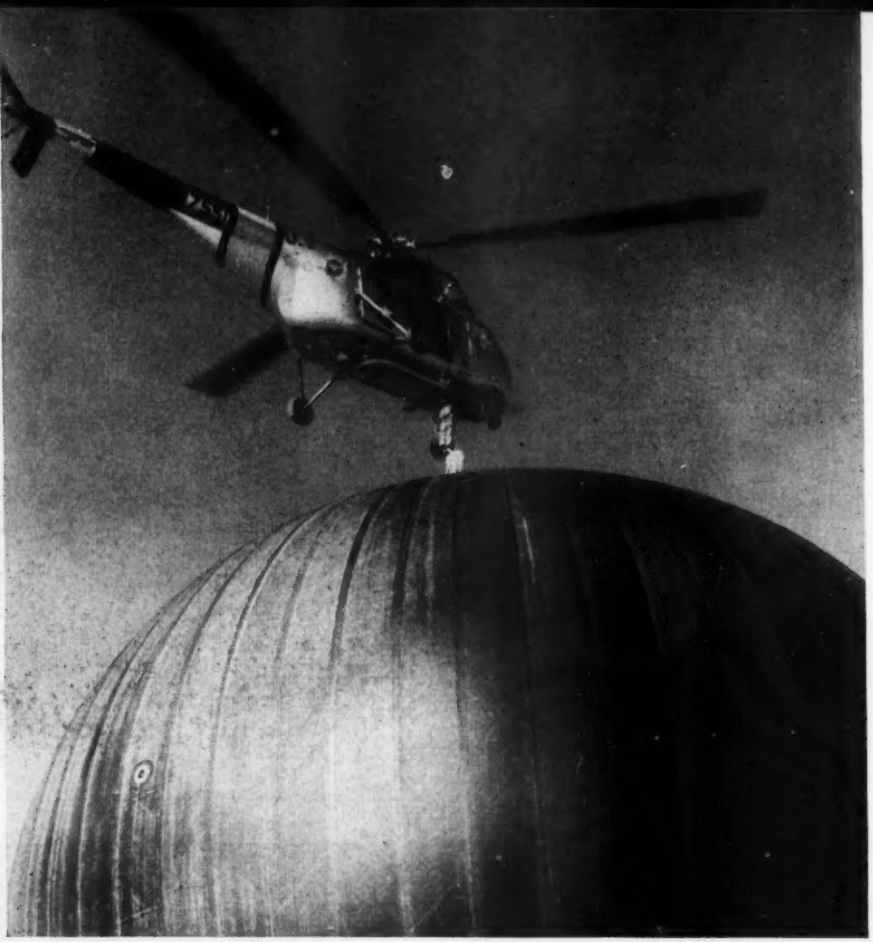
Air Pressure Lights Floodlamp

AN EXPLOSION-PROOF safety floodlight for use in mines and refineries gets its electricity from a built-in turbo-generator driven by compressed air. The 150-watt, 12-volt lamp draws 23 cubic feet of air per minute at pressures from 60 to 100 pounds, and is cooled by exhaust air. It will cut off automatically if the lens is shattered.

A shining tower, this 138-foot water tank of stainless steel will never have to be painted. Its 250,000 gallons supplement the city supply to give fire protection to the new General Motors Technical Center north of Detroit. The coppery reflection from the excavation below will change to blue when the 22-acre lake is filled.

Dedicated to all faiths, the Shrine of the Ages Chapel below will begin to rise this summer on the age-old Arizona Grand Canyon rim overlooking the site where Easter sunrise services are now held. Protestant, Catholic and Jewish altars, operated on hydraulic lifts, will take their places in the chancel in turn as needed.





Copter Drops Painter to Daub Frosty "Pumpkin"

WHEN a huge radome at Thule Air Base, Greenland, needed a paint job, the problem was how to get a rope ladder up to its chilly crown. The 55th Air Rescue Squadron solved it with a helicopter. A serviceman descended from the hovering craft and attached a ladder to the top of the fabric-covered building that houses the radar.

Pilot Wears His Movie Camera

AS PILOT of a "chase plane" during test flights for experimental McDonnell jets, Zeke Huelsbeck likes to make movies of the other plane's performance exactly as he sees it. Since he is too busy to use a hand-held camera, he bolted a gun-type job to his crash helmet at eye level. The camera is operated by a remote hand control.

New Cable Car Gives Striking View of Caracas

THE first car of Caracas' new $15,000,000 cable-car system nears a landing on 7,000-foot Mount Avila. Second longest in the world, the system connects with two adjoining peaks and the Caribbean. The spectacular Venezuelan project includes a circular, 14-story, mountain-top hotel and an ice-skating arena.

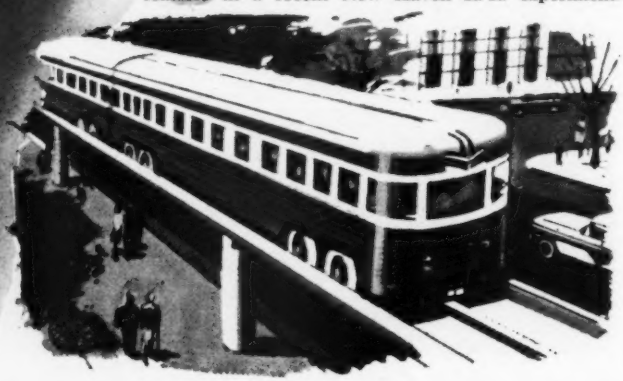
What's Coming Next?

Already on the drawing boards are ideas that may remake our world of tomorrow. Here is a glimpse into the future, at some of the most striking of the innovations that a recent survey has found forward-looking scientists, architects and engineers cooking up for us in the country's laboratories and workshops.

PSM DRAWINGS BY JO KOTULA

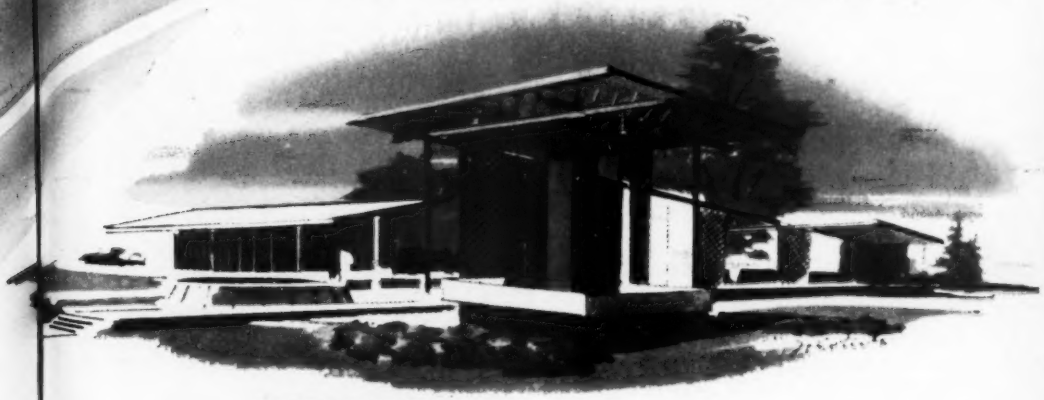
DRIVERLESS TRAIN

RAPID-TRANSIT PLAN of Henry K. Norton, New York, Susquehanna & Western R. R. president, proposes 60-m.p.h. pneumatic-tired trains without drivers, on roadlike elevated track with a central guide rail. When station agent throws lever closing doors and activating track, trainload of passengers proceeds automatically to next stop—an innovation shown feasible in a recent New Haven R. R. experiment.



MAN-CARRYING SATELLITE

NEXT SPACE-EXPLORING STEP after tiny unmanned earth satellites will be this more useful manned "satelloid," foresees Convair guided-missile expert Krafft A. Ehricke. His hybrid plane-spaceship would maintain itself for days in orbit of modest 80-mile altitude, as a 17,400-m.p.h. satellite, by intermittent rocket bursts; then glide back to earth. Tail and lower half of the forward section, rocket boosters for the winged part, are shed as shown during climb to orbit.

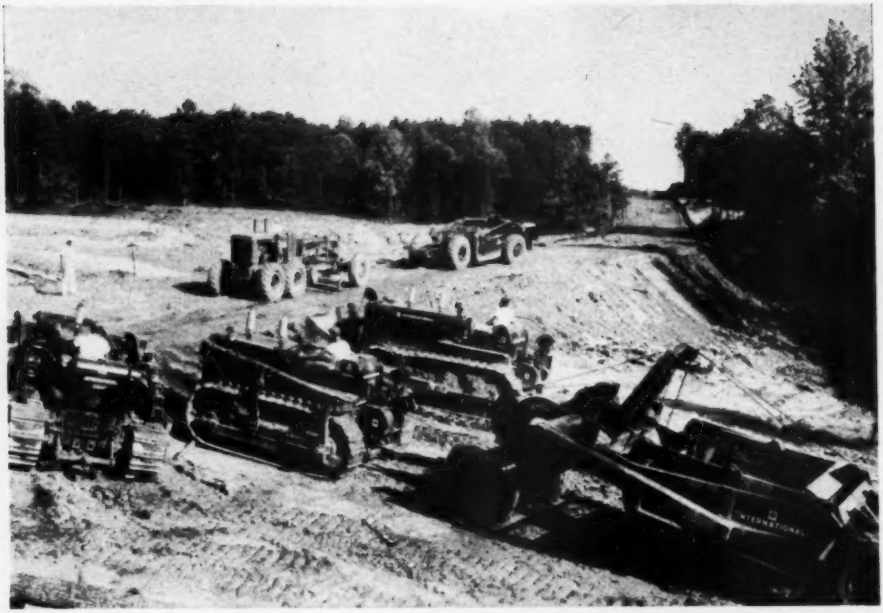


DREAM HOUSE

THREE-UNIT PLYWOOD STRUCTURE for vacationists, designed by San Francisco architects John Campbell and Worley Wong, is called "leisure house of tomorrow." Outdoor pavilion with sun shelf (foreground) offers sunbathing, resting in shade, swimming in pool across walk. Partly sunken, windowless "cave" with steplike seats (right background) invites gathering in evening around fireplace. Living area with kitchen and bath (left background) serves for eating, sleeping.

FLYING SUBMARINE

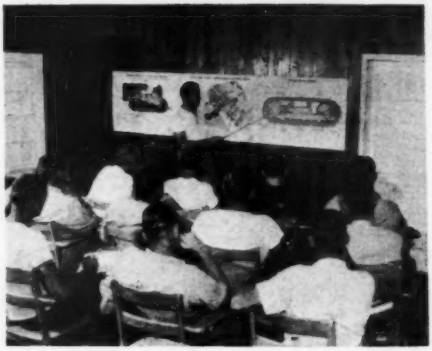
AT HOME IN WATER OR AIR, this combination craft would fly under power of a jet engine, and alight on water skis. With air intakes and exhaust sealed, it would then submerge and operate as a submarine, using a marine power plant and a retractable screw propeller. Armament could include two torpedoes. According to patentee Don B. Doolittle of All-American Engineering Co., Wilmington, Del., release of details has just been permitted by the Defense Department, which kept the patent of the flying sub secret for several years.

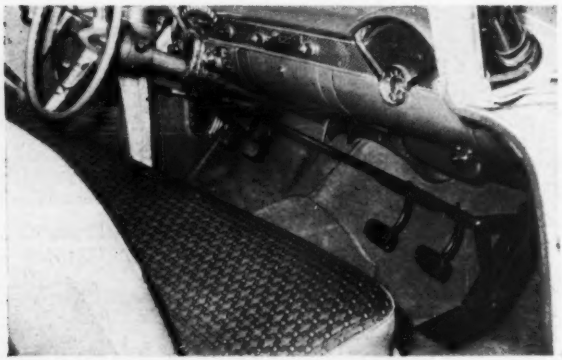


"Rip It Up" Is Motto at Heavy-Equipment School

FUTURE road builders learn how to handle big tractors, scrapers, graders and shovels at a new school near Charlotte, N.C. Their laboratory is a tract of virgin soil which they dig into and move around in order to obtain a diploma for the four-week course.

Backed by equipment dealers and manufacturers, the National School of Heavy Equipment Operations turns out trained operators in 218 hours of work—two-thirds in the field, the rest classroom study.





Quick-Change Unit Gives Car Control To Driving Teacher

A detachable duplicate-pedal mechanism now lets you put on your car, for driving lessons, the same dual controls that professional instructors have. Made by Portable Dual Controls, Inc., Detroit, for automatic or standard transmissions, the new safety device can be installed or removed in less than a minute.

SCINTILLATION COUNTER responds to faint radioactivity of common rocks, detects variations from average that may point to valuable minerals. This airplane-type model may also be used in car or afield. Detecting head, foreground, actuates meter on control unit in farther observer's hands.

'Black Box' Points Way to Oil and Gold

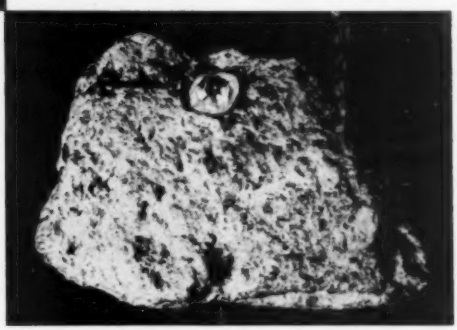
Sensitive meters read clues in rocks, to guide prospectors to the earth's mineral treasures.

By Alden P. Armagnac

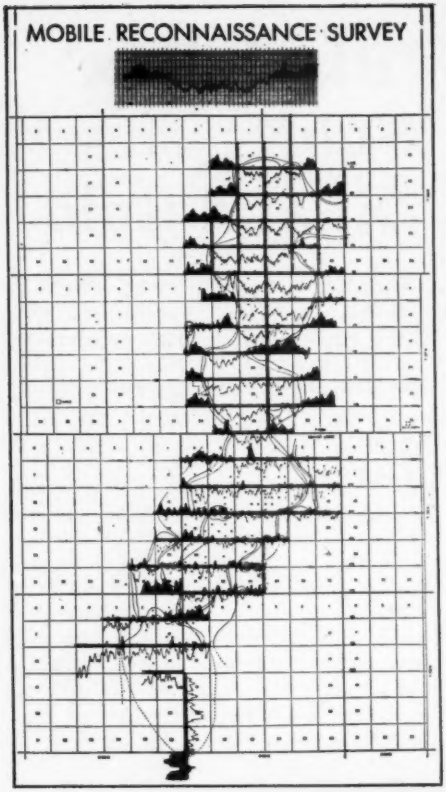
RADIOACTIVITY now guides gem hunters to diamonds, and modern forty-niners to gold. A new science called tracer prospecting offers prospectors an exciting new way to locate these and other valuable minerals—oil, iron, silver, copper and lead, among them.

Tracer prospecting takes advantage of clues in the form of minute amounts of radioactive substances in rock. Much as man-made radioactive "tracers" now tag materials in laboratory and factory, these natural radioactive tracers serve as indicators of other minerals in the earth, it has lately been discovered.

Number One tool of a tracer prospector is a high-sensitivity radiation detector —a scintillation counter or a multi-tube Geiger counter. In sensitivity, either instrument far excels the average uranium hunter's simple Geiger. Like it, the tracer prospector's counter will find uranium. But more than that, it will find other



DIAMONDS occur in kimberlite rock like specimen bearing this rough gem. Volcanic "pipes" of kimberlite are "dead" spots radioactively, and so can be spotted from air by low counter readings. Method promises discovery of new African diamond fields, and might find first of importance in U. S.

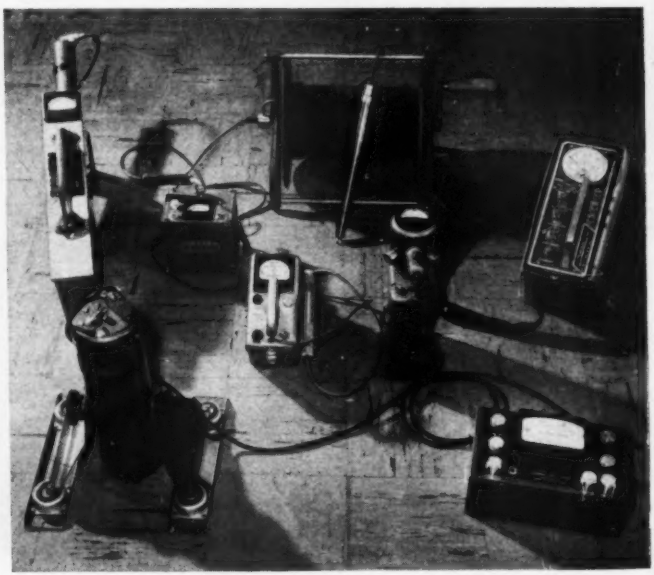


GROUND SURVEY follows grid lines taken from actual map of area. Truck with counter makes tape recording of radioactivity along each line (sample at top). Resulting charts (highs in black) are added to map. Pattern like this indicates oil or gas in buried river bed.

minerals that a less sensitive instrument cannot locate at all, by a new "tracer" technique that is based on these simple principles:

- All rocks are slightly radioactive, because they contain, on the average, a few thousandths of one percent of uranium. Different kinds of rocks, however, vary from this average. Granite, which contains quartz, shows a little more radioactivity than the general run; basalt, free of quartz, a little less.
- Not only is a scintillation counter sensitive enough to register the trace of radioactivity in common rock, but it registers, also, any departure from the average amount. It is these variations, *either* upward or downward, that interest tracer prospectors.

Gem explorers seeking diamonds in South Africa have lately been equipping themselves with airborne scintillation counters. By aerial search with these instruments, they expect to locate hitherto undiscovered "kimberlite pipes," the funnel-shaped bodies of bluish rock, ranging up to 2,300 feet in diameter, in which diamonds are found. Volcanic in origin, kimberlite rock belongs to the basalt family and so has subnormal ra-



TRACER PROSPECTORS use these tools: airborne scintillation counter (front, left and right); standard scintillation counter (center, right) beside ordinary Geiger counter (center, left); Geiger counter with king-size 26-inch tube (rear, left); drill-hole radioactivity probe with 1,000-foot cable on reel (rear, center); and 24-tube Geiger counter (rear, right).

AIRBORNE SCINTILLATION COUNTER in helicopter's plastic nose detects radioactive "anomalies," or variations from normal, on which tracer prospecting depends. Equipment of this Bell craft, specially designed for mineral exploration, also includes a portable core drill.

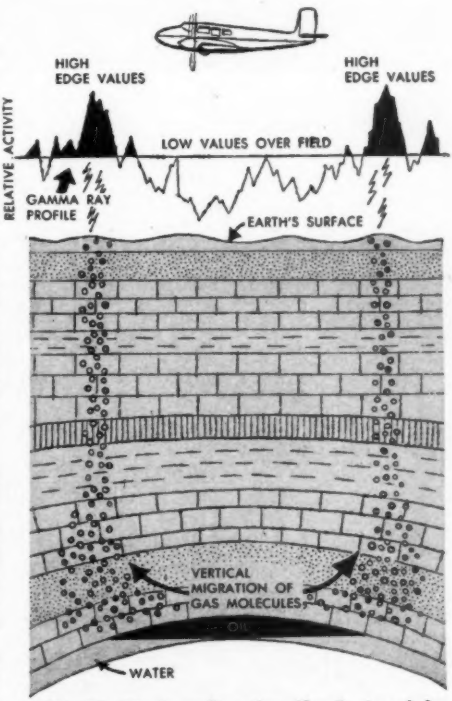
dioactivity. Wherever the aerial prospectors' instruments show a radioactivity "blackout," therefore, should be a likely place to look for the diamond-bearing rock formations.

Kimberlite pipes like Africa's are known to exist in the United States. A few modest-sized diamonds have come from one in Arkansas, where a small-scale mine has been worked from time to time, but domestic diamonds to date have been of more scientific interest than commercial significance. Now plans are under consideration to try out the new diamond-hunting method here, and its successful application could possibly make the U. S. one of the world's important diamond-mining nations.

Finding gold by tracer prospecting has been proven feasible, in a backhand way. Quite recently, ore from African gold mines has become an important source of by-product uranium—of which a small but valuable quantity is associated with the gold in the rich Transvaal and Orange Free State deposits. This presence of uranium in gold ore, geologists say, is by no means unique to these localities.

So prospectors for gold in other re-

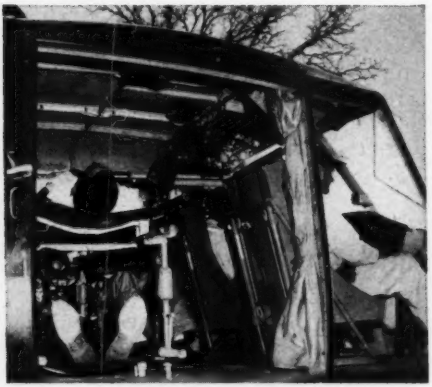
[*Continued on page 256*]



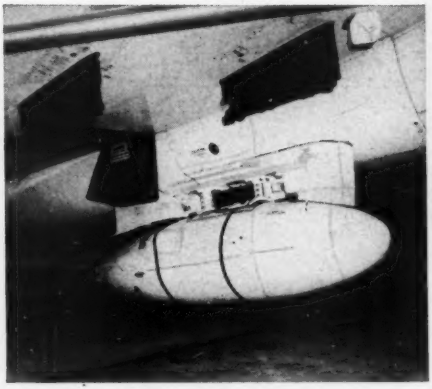
SIGN OF OIL is radioactive "low" ringed by "high" (top of diagram). One suggested explanation: Impervious cap rock, overlying oil, blocks and diverts radioactive-gas molecules rising from depths to surface, as in diagram.

New in Aviation

Visibility is good in this new Skimmer Amphibian. With the pusher prop out of the way and the cockpit forward of the wing, the pilot will have an unobstructed view as he sets his craft down on land or water. The three-place, family-type airplane is made by the Colonial Aircraft Corp., Sanford, Maine.

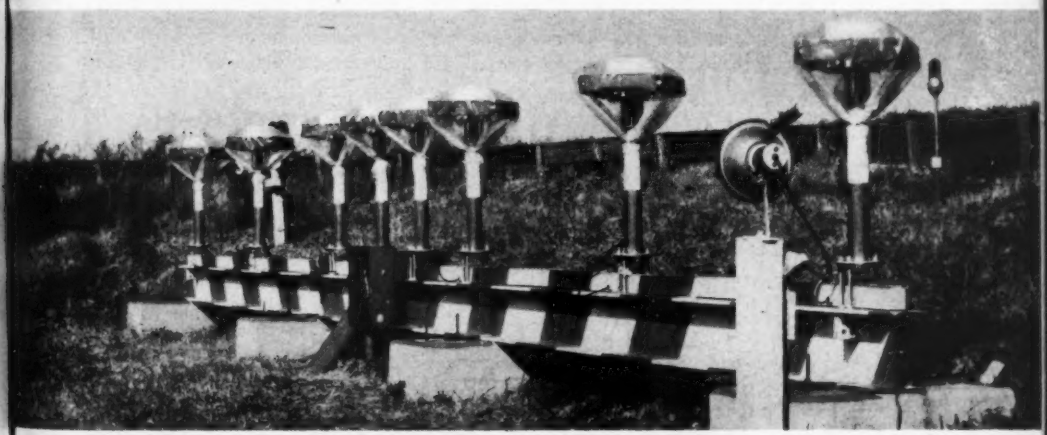


Litter patients fit snugly inside the large cabin of the Army's proposed new Bell XH-40 utility helicopter, shown in a mock-up view above. Rotor blades of the six-place craft will be powered by a turbine that will enable it to climb as fast as World War II fighter planes.



Pod starter: The bomb-like unit shown here slung under the belly of a McDonnell Demon Navy fighter contains a small gas turbine that compresses air to start the big jet engine. The five-foot-long, 450-pound pod can be used as a mobile ground-starting unit.

Four rotors, each with its own engine, give the name Quadrotor to a new type of helicopter being developed by Convertawings, Inc., Amityville, N. Y. Among advantages claimed are greater safety, less vibration. Model shown is for a 76-passenger transport version.

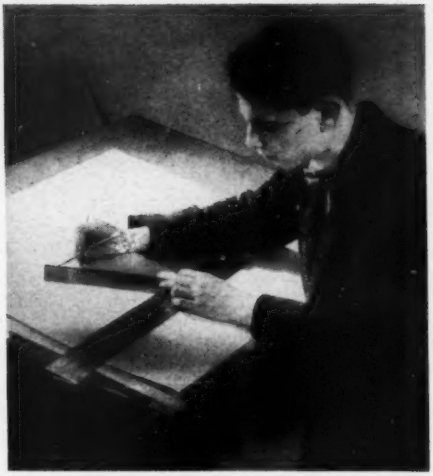


Plastic bags are being tried out as weather covers for the antenna arrays at instrument-landing runways. If they prove successful, says the Civil Aeronautics Administration, they will replace the present red-and-white shacks.

Copter spots sub, lands on same. Few aircraft of any kind have landed aboard a submarine. Among them is this Marine HRS-1 helicopter, shown as it settles down on the deck of the USS *Sea Lion* during recent training maneuvers off the coast of North Carolina.

Lensless Goggles Keep Out Wind

TESTED by the Navy in 70-m.p.h. icy blasts, these goggles show that an air cushion is more effective than lenses. Soft rubber seals the edge against the face, forming a stagnant layer that keeps out the wind. The goggles were designed by Dr. G. S. Macvaugh of Chevy Chase, Md., and his son Gilbert.



K Square Is 5-in-1 Drafting Tool

CALLED a K square by its inventor, a New York high-school senior, this drafting tool replaces a T square, 30-60-90-degree triangle, 45-90-degree triangle, protractor and ruler. Young Lawrence Kalmis (above) adjusts a knob to control the angle of its leg and horizontal movement in a grooved slide.

NYU Builds Reactor in a Pickle Barrel

Two tons of uranium rods and two grams of radium-beryllium in a pickle barrel give New York University engineering students a subcritical reactor for nuclear experiments. It is safe, realistic, but won't sustain a full chain reaction.

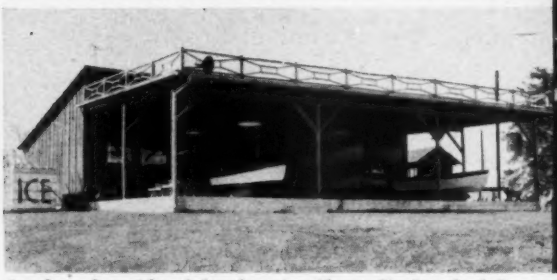
Plastic Roof Proposed to Keep Dodgers Dry on New Field

RAIN checks may become obsolete at the new stadium proposed for the champion Brooklyn Dodgers. Graduate architectural students at Princeton designed this scale model with a translucent dome to keep field and fans dry, and with no posts to block vision. Half underground, the bowl would be high enough to clear home runs and most fouls.

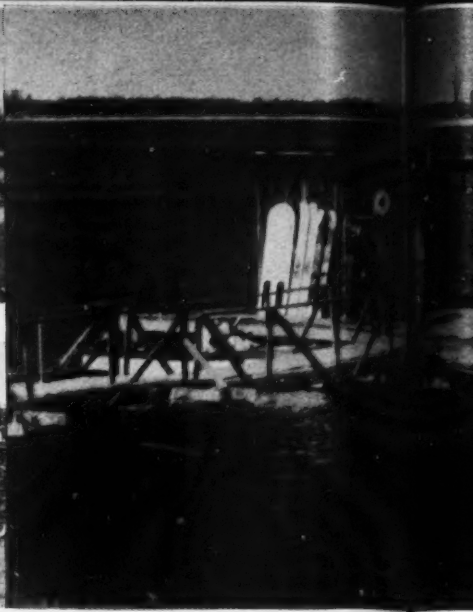
Light-Delivery Jeep with Two-Wheel Drive Has Sliding Doors

NEWEST of the Willys Jeep line is this two-wheel-drive Dispatcher. A low-cost ($1,284 up) light-delivery vehicle, it will be available in three models: a steel and fiber-glass-reinforced plastic hardtop with sliding doors on recessed outside runners (above), a model with or without canvas top, and a soft-top convertible. Each is being made with left or right drive, the latter for foreign sales and rural mail delivery from the driver's side.

Before launching, boaters stock up at Tar Heel Marina.



On the other side of the shop is a "boat-display deck."



Tar Heel's new-idea "breezeway float"

has

Wanted: Marinas

Parking and servicing America's growing fleet of outboards is a booming business on lakes, rivers and salt-water shorefronts.

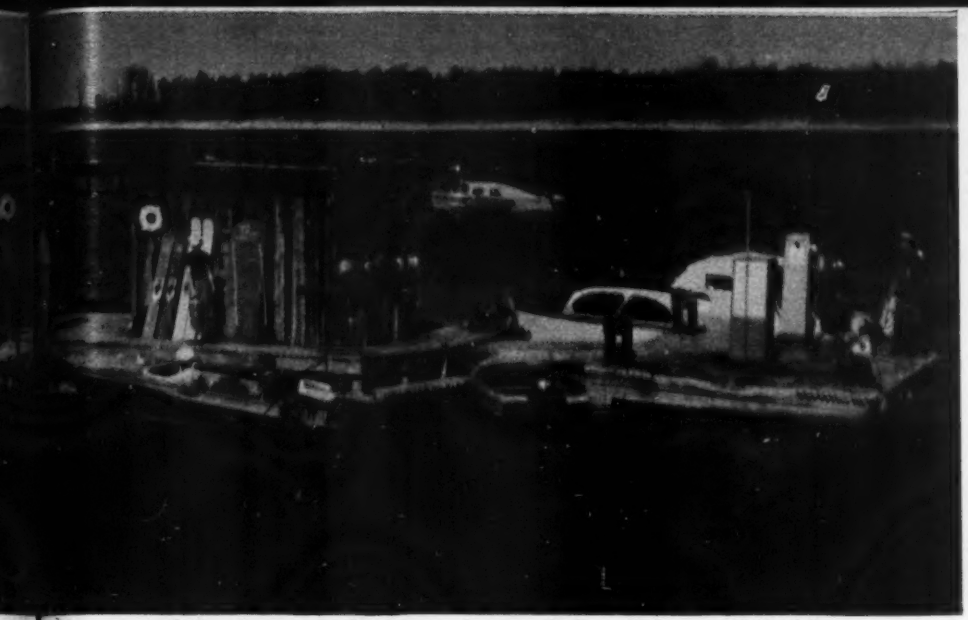
By E. D. Fales Jr.

WITH more than 4,000,000 outboard boats now in use—and more coming—there's a tremendous, rising need not only for boat ramps and repair shops but for boat parking space.

As just one sample, the waiting list for boat moorings in the city "marina"

INSTEAD OF CHICKEN FEED this 50-foot monorail now whisks boats around in Del Wilson's shop. New, he says, it would have cost him $1,000. He got it for $70 at a chicken farm.

WHEN WATER LEVEL DROPS and breezeway float must be eased out into deeper water, it is "winched" out on cables that run to deep anchors. When lake rises, float is cranked back.



has storm shelter in center, shops on ends. Gas dock could be cut adrift if fire ever started.

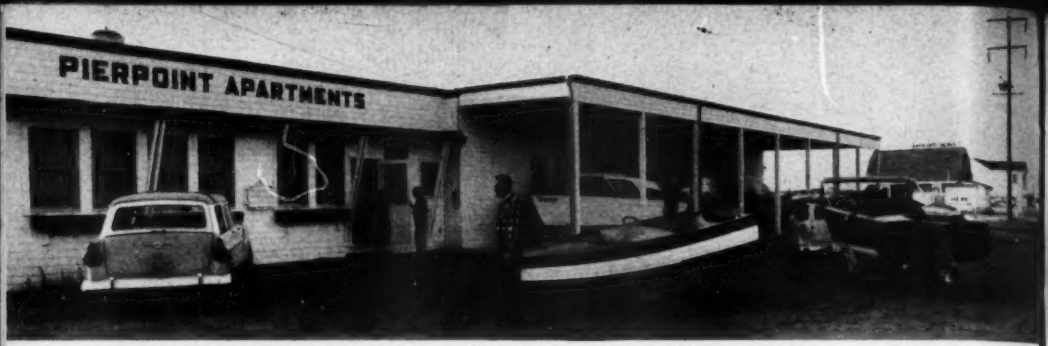
for 4,000,000 Boats

at Mamaroneck, N. Y., is 400 boats long.

You may never have heard of a marina (most people haven't), but the boat industry says that no fewer than 10,000 are in operation today on U. S. lakes, rivers, bays. And 450 more are now being built. But—says the National Association of Engine and Boat Manufacturers—boat-servicing facilities are already so crowded that the country could use another 10,000 marinas immediately.

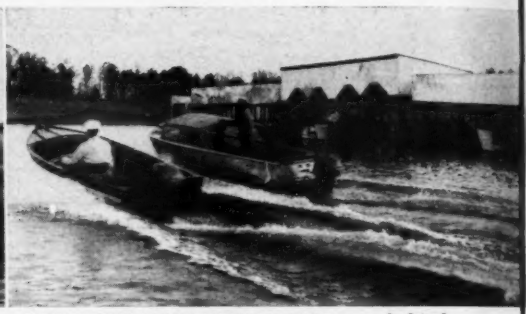
What is a marina? A few seasons back the name meant a modern small-boat harbor, with complete (and sometimes swanky) docks and service. Now practically every boatyard that has at

EVERYTHING FROM SKIFFS to 67-foot diesel yachts tie up to marina piers. This is a pier that Bill Walker built (with Mrs. Walker's help) at Kilmarnock, Va. Light crane on pier is used for hoisting outboard motors. Walker made it for a few bucks by using steel pipe cut from a gas station sign pole for the mast. Pier cost $2,000; oil companies sometimes pay half.



"BOATELS" ARE THE NEWEST THING in marinas. Del Wilson built five apartments right into his marina at Rehoboth, Del. Man at center pulls a boat on four-foot dolly that Wilson designed.

HUSKY "HIGH-BANK" RAMP was built by Bill Walker when he found that his beach was too steep for trailers. He laid oak planks between 3"-by-4" steel angles, each 30 feet long.



HUGE SYSTEM OF FLOATING DOCKS, seen behind passing outboards, protects some boats on Kerr Lake. Many owners pay extra for these covered slips which protect their boats from weather.

least a gas pump is calling itself a marina. Some marinas aren't even on water. One in the desert at Tucson, Ariz., sells and services boats for owners who have to "trail" long distances to water.

A big marina is quite an impressive operation. It must have (1) ramps or cranes or a marine railway to get boats into and out of the water, (2) several piers for boat parking, (3) a good repair shop, (4) a large stock of motors, boats, tools, paints, rope, lights and so on.

Perhaps the world's largest is being built at Newport, Calif. It will park 3,000 boats—and 4,000 cars. At Fort Lauderdale, Fla., another big marina, with 500 boat slots, has 28 shops filled with the innumerable items that boatmen buy.

Some marinas are publicly operated by city park departments, but most are privately owned. A man can turn a good profit—or lose his shirt—depending on how good a salesman he is, and how handy with tools.

At Washington, N. C., Dennis Smithwick needed a 1½-ton crane. A new one would have cost $1,000 or more.

"But I found steel from an old highway bridge and welded two reinforced channel girders into a 24-foot boom," he told me. "Another girder became my mainmast. Total cost of all the steel parts for my crane: $75."

At Copiague, L. I., two men bought a boatyard and at once ran into a problem: customers beefed because they couldn't get their boats out on short notice. (Some boats, naturally, are winter-stored back in the yard, behind many others.)

"We needed a big walking crane," said Stewart Strong. "That's a big expense. So we went to an auction, bought an old power-company truck for $250. It was too old for road use, but fine for our yard. And there was $1,000 worth of gear on it: a winch, a big electric motor and a long crane, once used for lifting power poles. Now we 'walk' boats out of any spot in the yard in minutes."

After bulldozing a marina out of a

jungle, at Kilmarnock, Va., Bill Walker needed $1,000 for dredging (which costs around $1 a yard).

"To save money, I tried asking boat owners if they'd work their boats for me for an hour for $8 or $10," he said. "I'd anchor them in the shallow water I wanted to deepen, with the bows toward shore. Then I'd have them start the props and fishtail their boats back and forth.

"We found that, by fishtailing, a 30-foot cruiser with a large propeller could fan our sandy mud out into deep water. We knocked two or three feet of mud away from our dock. Our total dredging cost about $45."

At Rehoboth, Del., "Del" Wilson wanted an overhead monorail crane. You can buy a new one for $1,500.

"We looked around until we found one in an abandoned chicken barn," he said.

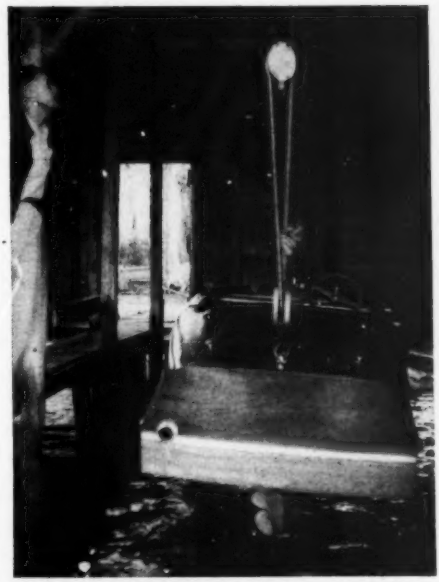
Del also found that it took four men to move a 315-lb. cruiser around his shop. So he built a midget dolly only four feet long, cut an axle from pipe, and added two wheels taken from an old baggage porter's truck. Now one man can pull a big boat around with one finger. Further, he can load a boat on the dolly single-handed—by propping up the bow with an ordinary garage hydraulic jack.

Even an old road-scraper came in handy for Dennis Smithwick at Washington, N. C. He removed the 40-to-1 hand winch formerly used by its crew for raising the blade. Now that winch is installed over one of his boat-parking slips. When an owner comes in from a trip, he pushes a lever. A ¾-hp. electric motor turns the winch and lifts his boat three feet out of water. There it stays until the owner takes another trip. Result: the owner has found that instead of having to paint his boat every year, now once every three years is enough.

So many owners liked the road-scraper hoist that Smithwick bought six more from scrap yards. Now he gets an extra $2 a month from each slip. The above-

[*Continued on page 261*]

THREE OLD BRIDGE GIRDERS went into the making of this husky crane at Dennis Smithwick's marina in Washington, N. C. He paid about $65 for them, saved several hundred dollars.



BOATS ARE "PARKED" a foot or two above water in Smithwick's marina. This makes annual painting and varnishing unnecessary, he says. Boats that might warp should be cradled.

Coming next month: A 24-page Spring Boat Fair

Amateur Astronomer Builds His Own Back-Yard Palomar

IMPRESSIVE as his private observatory looks, Martin Vann is still more proud of the 16-inch telescope glimpsed above through the door as he mows the lawn behind his Los Altos, Calif., home. He built both the observatory and the telescope himself.

Vann, who works for a plumbing firm, values his star-gazing setup at $20,000. He first assembled the high-power telescope for a closer look at the stars; then built the miniature Palomar to house his equipment, using tempered hardboard for the dome.

They Say Now...

THOMAS E. MURRAY, COMMISSIONER, ATOMIC ENERGY COMMISSION: *"There is a limit to the number of large thermonuclear explosions that the human race can withstand. I propose that we . . . detonate a large thermonuclear weapon (at Eniwetok) before an audience representative of all the peoples of the world. . . . What they would see would leave no doubt in their minds with regard to the meaning of disaster."*

LEWIS L. STRAUSS, CHAIRMAN, ATOMIC ENERGY COMMISSION: *"If there is to be another war (it) may be survived by the country with the greatest stockpile of nuclear weapons. . . . But such a war will almost certainly be lost by the country with the fewest resources in trained manpower."*

FRANCIS J. GRIFFIN, EDITOR, CHEMISTRY & INDUSTRY, LONDON: *"When the problem of making science teaching attractive financially to men of imagination and ambition has been overcome, the need will still remain for making the best use of those the profession already has. The science teacher is the kingpin of industrial prosperity."*

PROF. FARRINGTON DANIELS, UNIVERSITY OF WISCONSIN: *"By a judicious combination of fossil fuels (coal, oil, gas), atomic energy and solar energy, the whole world can have within this century all the mechanical power and material comforts that it wants."*

GM Firebird II was shown last month, after secret highway tests, as "a progress report" on experiments toward gas-turbine passenger cars. Hooked to its kerosene-burning 200-hp. engine is a heat exchanger that uses the exhaust to warm incoming air, improving combustion and saving fuel. The car, seating four, is 19 ft. 7 in. long, 4 ft. 4 in. high at the tail. The body is titanium.

3 Cars You Can't Buy

Packard Projector was dreamed up for drivers who prefer to get into and out of a car without bumping their heads. Roof panels retract when the doors open, and seats swivel outward. Headlights are recessed behind push-button lids. In the rear are four exhaust ports, to cut back pressure.

Mercury Turnpike Cruiser also offers no-stoop entry: Transparent panels flap up when you open the doors. Skinny roof posts and compound-curved glass "permit full enjoyment of the wide new vistas opened to turnpike travelers." The car's own turnpike travel, between auto shows, will be in a glass-sided trailer.

NICKNAMED "TORNADO TOWN," this is the heart of the 250-million-dollar Arnold Engineering Development Center. The Propulsion Wind Tunnel is at left center. At left rear is the Gas Dynamics Facility, where models will be tested at 10 times the speed of sound.

Biggest electric fans whip up

Air for Tomorrow's Airplanes

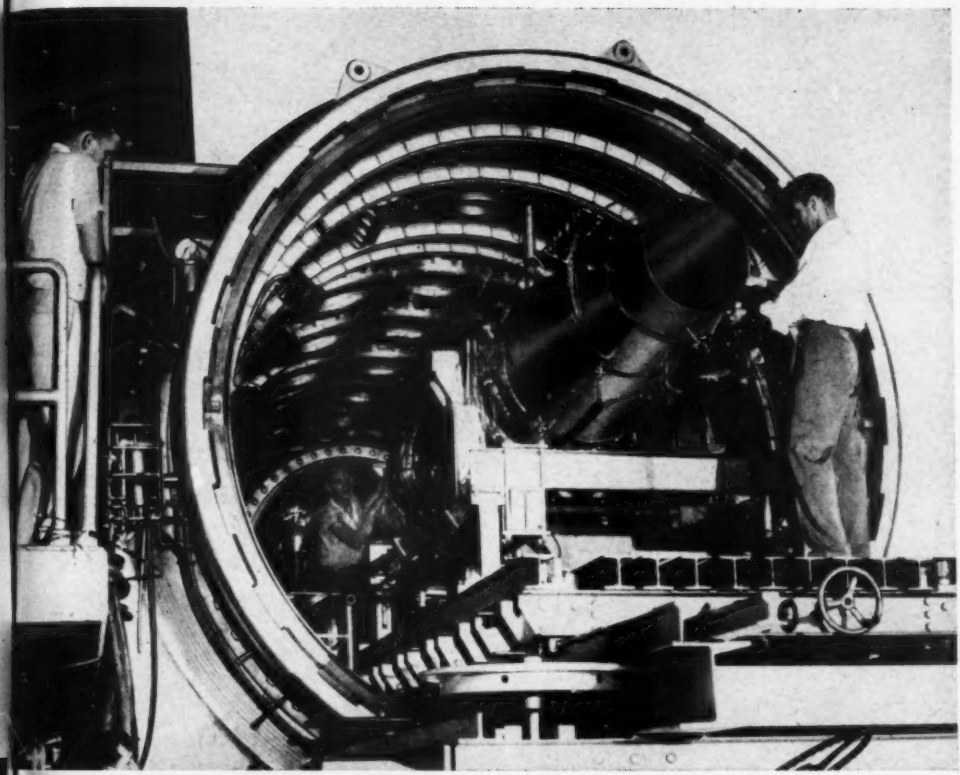
By Henry B. Comstock

YOUR future and mine may depend on a 250-million-dollar atmosphere factory just being put into production in the middle of 44,000 acres of barrenlands near Tullahoma, Tenn.

This weird assembly of vacuum spheres, high-pressure bottles and steel tubes—some of them as big around as a four-track railroad tunnel—is the Arnold Engineering Development Center.

AEDC—as this pipe-dream-come-true is known to its owners, the U. S. Air

MAIN CONTROL STATION for the Engine Test Facility sets up routes for air being fed to wind tunnels. Velocity, density, temperature and humidity are all made to order here.



FULL-SCALE JET ENGINE is wheeled into a cell for testing. Recently a turbojet threw its entire compressor rotor harmlessly against the walls. Result: the life of one test pilot was saved.

Force—is the world's most powerful and versatile wind-tunnel station. Soon it will be whipping up air in more ways than they serve potatoes in France.

Here's one typical AEDC testing menu:

- Air traveling at 7,600 miles per hour, or 10 times the speed of sound.
- Air heated to 1,500° Fahrenheit—hot enough to braise a steak in less than a second.
- Air compressed to a fourth the density of water.

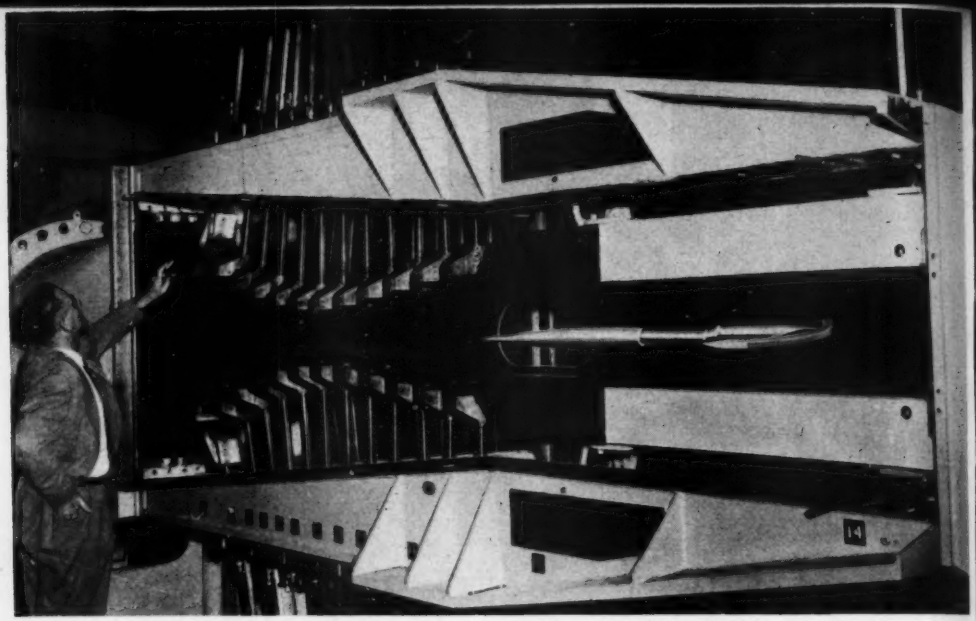
If that sounds like a rugged diet, it's meant to be. Because the technicians at AEDC are out to blend air velocities, air temperatures and air densities into every kind of torturing atmosphere that may be poured down the throats of tomorrow's supersonic engines, split by the airfoil sections of tomorrow's fighter planes, or shock-waved from the heads of tomorrow's hypersonic missiles.

Theory into weapons. AEDC is named for the late General Henry H. Arnold, chief of the U. S. Army Air Forces in World War II. What he proposed, in 1944, was not just another research laboratory, but a high-speed processing plant that could take the best products of research and turn them into refined and proven aerial weapons in weeks and months, instead of months and years.

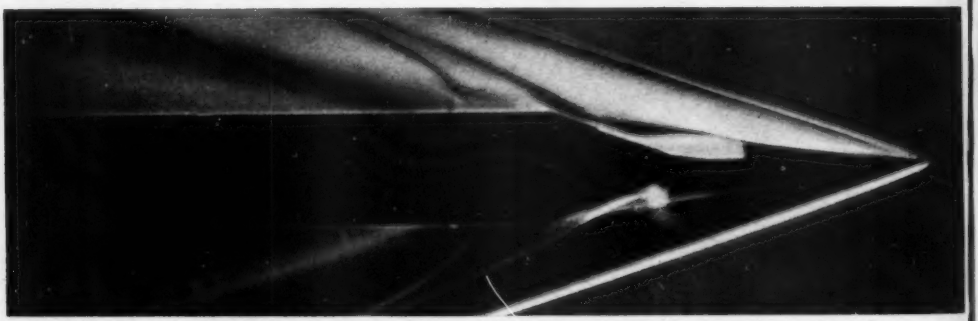
"For postwar air supremacy," said "Hap" Arnold, "we must buy *time* at any cost. The place to buy that time is in the development stage."

At AEDC they're already beginning to do the job, fast and thoroughly.

Let's say that you have just built a



ADJUSTABLE JACKS shape flat steel plates to form a nozzle contour which, combined with the quantity of air being fed through it, sets up the desired wind velocity in the test cell.



DIFFERENCES IN AIR TEMPERATURE make it possible to see the shock waves at the head of a missile under test. Walls lining the cell are perforated to prevent the waves from rebounding against the rocket, creating an air drag that would not exist in actual free flight.

pilot model of a brand-new jet engine. You have convinced the Air Force that you have a potentially hot item—powerful enough, perhaps, to send an attack plane streaking on its mission at twice the speed of sound.

A date with AEDC. You won't be able to trot right down to Tullahoma and give your product an invigorating whiff of 1,500-mile-per-hour air. But as soon as AEDC's present backlog of turbojets, turboprops and ramjets has been fried and frozen, glutted and starved, drowned in humidity and parched, you'll get a date to set up your engine on a test cart at the Center. There, in a walled-off shop, away from the prying eyes of your competitors, skilled technicians will fasten fancy respiratory gimmicks on your precious chunk of steel.

When it comes "tunnel time," the cart will trundle your engine into a steel cell 12 feet in diameter and from 32 to 90 feet long. A seal will be set up between the intake section and the tailpipe to record the power plant's "bite," or thrust.

Then, while the engine bursts into its full-throated roar, air dispatchers in an

elevated blockhouse will begin pouring on the atmosphere. A touch of a single switch may flip as many as 400 six-contact relays. Lights will dance in an orderly pattern on an overhead panel that looks like the track-layout board at Grand Central Station. The route is clear for the howling tornado set up by a bank of compressors powered by electric motors totaling 20,000 horsepower. Skillfully balancing their output, a 40,000-horsepower battery of evacuators (compressors in reverse) will draw away the gases that streak from the engine's tailpipe.

Air—fast, cold and thin. Suppose your engine passes every level-flight test with flying colors. It gobbles up the tunnel's highest air velocity—bellows its defiance when the temperature drops to minus 120° Fahrenheit—gets a good bite on the lean stuff you'd find 15 miles above the earth.

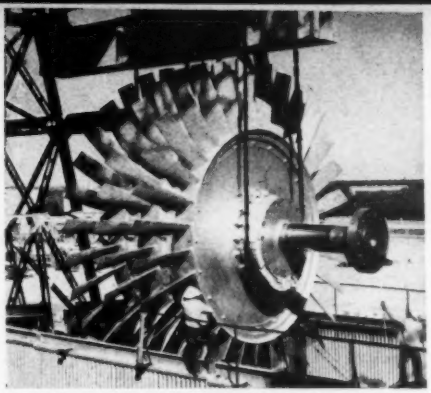
That still doesn't show how it would behave if you put it into a dizzy power climb or a screaming dive. If you could only tilt the engine—but you can't. There isn't enough room in the cell.

AEDC is way ahead of you. A flip of a switch and the nozzle that jets air into the cell slowly changes its line of attack. In effect, the engine is tilting now. By directing the air flow upward, then blasting it horizontally, and finally, deflecting it downward, every condition from take-off to landing will be faithfully reproduced.

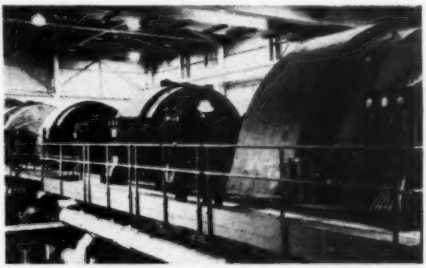
While your engine is in the cell, you can watch its performance from moment to moment on a TV screen. At the same time, your engineers and those at AEDC will be taking instrument readings and feeding them into a 19,000-pound electronic brain—one of three at the Center. There, 2,700 vacuum tubes will work up a fever, relieved by enough air-conditioning apparatus to cool a small theater, while they blend this raw data into useful information.

TV for the boys at home. In 30 seconds the big computer will type out answers to problems that would keep a

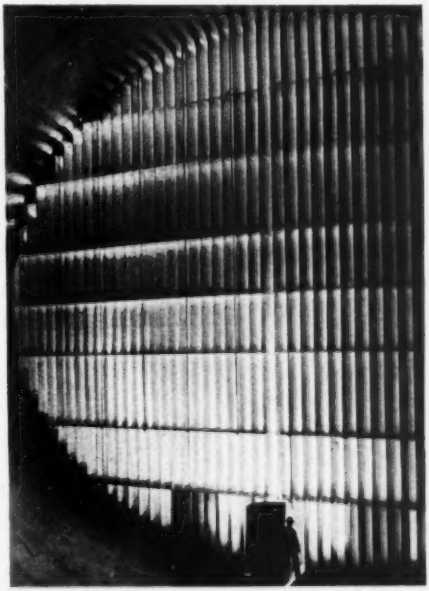
[*Continued on page 258*]



WORLD'S BIGGEST COMPRESSORS have 18-foot rotor drums. At 600 r.p.m., each of the 96 blades on this drum exerts an 800-ton tug.



TWO END MOTORS in air-compressor driving train weigh 225 tons apiece. Each contains over 31 miles of wire, develops 83,000 hp.



BANK OF LOUVERS, of curved cross-section, will bend the flow of supersonic air around a right-angle elbow in Propulsion Wind Tunnel.

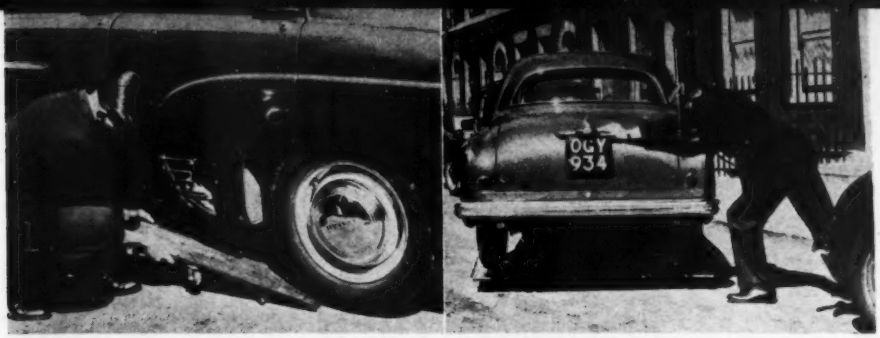
Water "Tunnel" Checks Behavior of Weapons at 100 Knots

WHIPPED at high speed through a million-gallon circular tank of water, missile models underslung on this 122-foot beam are studied to see how different shapes behave when launched into water from the air. British Admiralty experts conduct hydrodynamic research at Teddington in the same way that aerodynamic tests are made in wind tunnels.

New Solid Fuel Can Be Handled Like a Liquid

FLUID coke—so called because, suspended in a stream of air and oil vapor, it can be poured like a liquid—is now being used commercially for the first time. Public Service of New Jersey has substituted it for oil at a big generating station. The new fuel, which looks like black sand, is shown here being poured into a hopper-bottom railroad car at a Billings, Mont., Esso refinery.

Tarry residues from gasoline refining are used to make the fluid coke. Esso men say that the process also enables them to extract an extra 10 percent of gasoline from a barrel of crude oil.

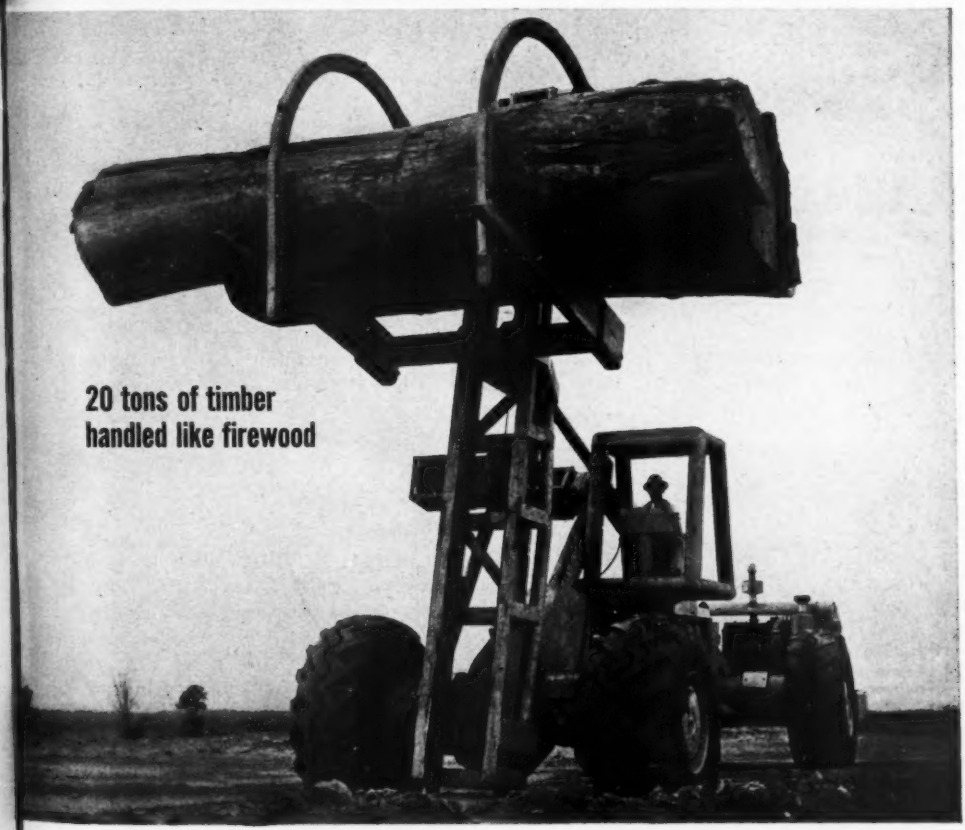


Un-Parking Gadget to Get You Out of Tight Curb Squeeze

CHARLES RYAN and Co., Ltd., London, say that they have just the gadget to un-park your jammed-in car: two 2½-foot steel platforms on ball-bearing casters. You put one under each rear wheel, drive up on them, get out—and push. With clearance forward, why couldn't you wiggle out yourself? Ryan doesn't say. Power steering, anyone?

Giant Electric Stacker Picks Up Logs by the Truckload

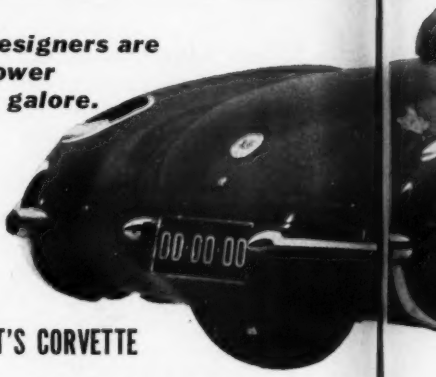
CAPABLE of lifting an entire truckload of logs with each bite, this Texas-built electric log stacker makes quick work of loading and unloading. The operator of the big rubber-tired LeTourneau machine pushes its 10-foot wedges under the logs, clamps them in its jaws, lifts them on the upright I-beam rails, trundles them off, and stacks the whole mass of logs neatly on a logging-camp truck or lumber-mill processing or stock pile.



New Corvette Challenges Thunderbird and Hawk

Three snappy products of the sports-car designers are off and running with fresh packages of power under their hoods—and cockpit gadgetry galore.

By Ken W. Purdy



CHEVROLET'S CORVETTE

GENERAL MOTORS has made more money than anybody else has earned since the first man sold a stone spear for a dozen clamshells, but all this economic muscle hasn't prevented the Ford Thunderbird from knocking the ears off Chevrolet's rival car, the Corvette.

The Corvette, if the sordid truth were faced, was nobody's dream car. It was a dumpy, lumpy-looking wagon, strictly non-sexy from the tea-strainer headlight covers to the dual pipes with their unhappy tendency to stain the early fiberglass bodies. With the flathead six-cylinder engine it wouldn't really go, and even wearing the alternative eight-cylinder 195-horsepower version, it was no competition sensation.

There were a trifling few other things wrong with it, too. When you bought a Corvette, you bought an automatic transmission, like it or not, and a good many citizens didn't. The top required the usual two men and a crowbar to erect, and in a rainstorm water came through all the places you could see and some that you couldn't.

Out with the old. So the Corvette didn't catch on and production trickled down to a few cars a day, ending altogether in December. What now? A new Corvette, and a horse of quite another color, even literally: You don't have to settle for Polo White or Pennant Blue any more; you can choose among a half-dozen colors, with harmonizing interiors. But there's more than a new paint job.

Styling changes in the '56 Corvette are slight, but they have improved the look

THE AUTHOR: Ken Purdy, shown with the Studebaker Golden Hawk in South Bend before his trial spin in this new U.S. sports car, is a well-known writer on automobiles. He is the author of two books about cars, *Kings of the Road* and *Bright Wheels Rolling*, and is a former editor of *True* and *Argosy* magazines.

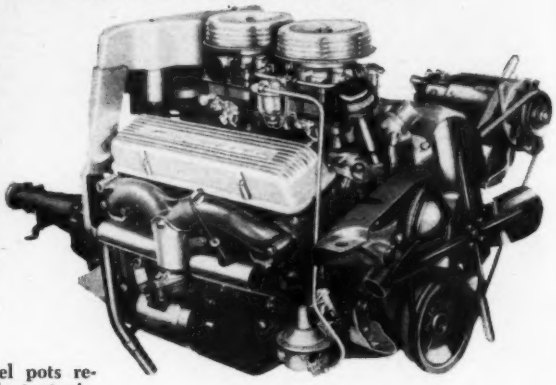
FORD'S THUNDERBIRD

STUDEBAKER'S GOLDEN HAWK

of the car enormously. (It's still fiberglass, of course.) The bashful-looking headlamps faired into the front wings are no more. They've been replaced by the standard, aggressive lights more nearly like the rest of the Chevrolet line. The engine-compartment lid has a pair of molded contour lines running straight back, probably strictly non-functional, although they might create enough turbu-

DEEP INDENT IN SHEET METAL runs from the wheel well back into the door.

Details on Corvette show marked changes in style and power



V-8 ENGINE with two four-barrel pots replaces last year's somewhat reluctant six.

lence to louse up the flight pattern of a large June bug, at that.

The biggest body change is on the side of the car, an indented airfoil form running from the wheel arch into the door. The old Corvette looked like a dish of vanilla ice cream under a sun lamp; this one has the doing-60-standing-still appearance that motorcycle cops find so compellingly attractive.

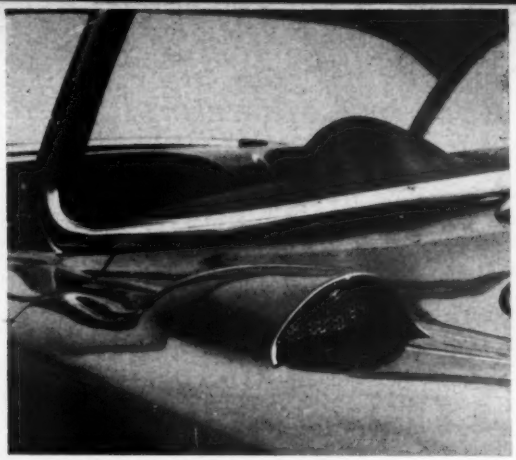
Automatic top. It's good inside, too. There are wind-up windows and an automatic top. It folds out of sight under the same lid that hid the old one; but when you push the button on the '56, the lid rises silently, the top comes out and spreads itself, and you're in business. It's alleged to be watertight, too. Or you can have a hardtop if you'd rather.

The steering wheel is the big tip-off: testimony to GM's new-found interest in competition and its determination to take no more guff from T-bird drivers. It's the kind of wheel that costs about 60 bucks to buy off the peg: three flat, drilled-out steel spokes, a leather-covered rim, strictly Grand Prix with a touch of luxury. The spindly gear-selector level of yesteryear is gone, too, replaced by a stiff and stubby handle governing a brand-new close-ratio manual box. In case you've forgotten how to run a stick shift, the four gear positions are embossed in a metal plate on the floor.

Horsepower is up to 225 and Chevrolet engineers are willing to be quoted as saying that it may increase further. Since nobody at General Motors from the elevator operators up ever says anything just to hear himself talk, this means that another 25 or 50 horses are in the stable waiting for somebody in Dearborn to raise the ante. This is a 265-inch engine, running at 9.25:1 compression with two four-barrel carburetors, solid lifters, a modified inlet and exhaust system and a hot camshaft. Only a prototype was available when I was in Detroit, so I didn't drive the car, but obviously it will be quick, and it should come as near as no matter to 120 miles an hour.

For police cars and Corvettes. No basic changes have been made in the Corvette chassis except for some minor diddling with the front end. It's still the box-girder X-braced frame carrying the front stabilizer bar that Chevrolet uses only on its police cars and Corvettes. Chevrolet engineers were satisfied with the handling qualities of the car as it was, and so apparently were most of the customers, although there were some notable dissenters from that opinion among the competition-minded sports-car crowd.

Incidentally, Chevrolet executives say that careful vote-taking among Corvette owners dictated all the changes that were made, and that the customers have been



SIMULATED AIR SCOOPS adorn the front fenders. The wheel covers have make-believe knockoff hubs.

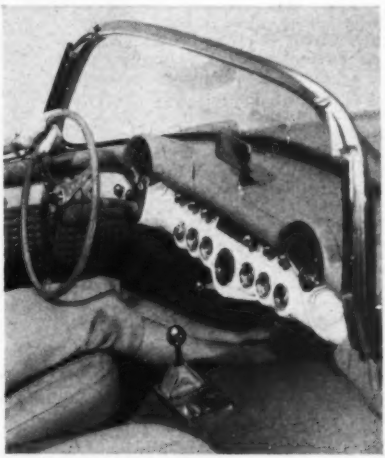
STANDARD-TYPE HEADLIGHTS groom the front of the Corvette. Six body colors are offered for '56.

given everything that they asked for with one exception: the bumpers. More drivers than not disliked them on the old Corvette, but the designers haven't changed them in the '56 except to beef them up a bit in front. Esthetically they are right, since the bumpers do flow nicely into the lines of the automobile, even if they don't afford as much protection as those on a Mack truck.

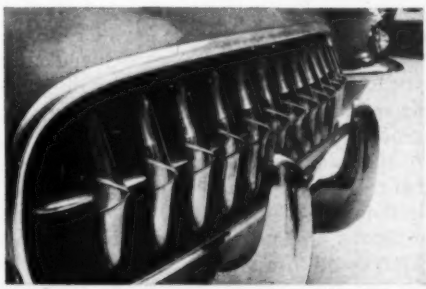
Ready for the races. This is a good-looking motorcar, certainly it's a comfortable and convenient fast touring car, and it is probably much more than that. It doesn't take a major prophet to suggest that the Corvette will be showing up in competition next summer. Before plans for the car were frozen, Chevrolet designers had initiated conferences with Sports Car Club of America officials, to be sure that the car met SCCA competition regulations. This is a far cry indeed from GM's attitude of a half-dozen years ago, when racer Briggs Cunningham's request for help in setting up his Le Mans/Cadillac was answered by a form letter suggesting that he drop in and see what was on the floor at the New York dealership. The dope is that well-staffed Corvettes will run this year at Sebring and Le Mans.

In terms of competition, Chevrolet is thinking about Ford, as certainly the

[*Continued on page 262*]



SHIFT LEVER ON FLOOR connects directly to the transmission housing. Better linkage supplies faster and more positive shifts.



BUMPERS ARE BEEFED UP but the grille remains unchanged. The car is an inch longer overall.

Good-by, carburetors!

Fuel Injection Is Coming This Year

By Devon Francis

INJECTION PUMP is heart of fuel-injection system. Fuel enters it under pressure of 17 pounds per square inch, created by a secondary, electrically driven pump. It is ejected to cylinders at 100 to 300 pounds' pressure, depending on volume of flow, through ring of outlets. Upright cylinder controls the fuel volume.

BEFORE the year 1956 becomes history, Detroit will be building fuel-injection automobiles. They will have no carburetors. They will serve as a time fuse for an explosive revolution comparable to the introduction of the high-compression V-8 seven years ago.

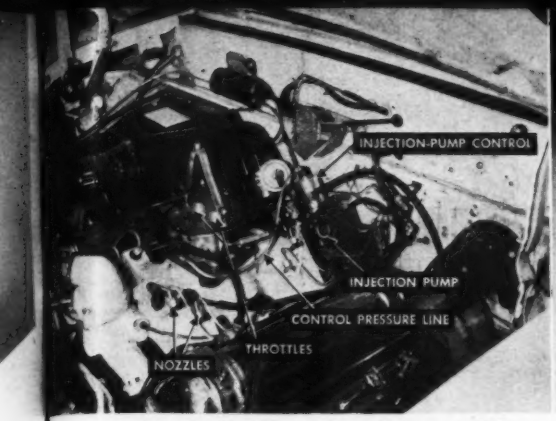
Fuel injection will:

- Boost full-throttle horsepower output by 10 percent on current engine designs. When engines are redesigned specifically for fuel injection, horsepowers will climb as much as 25 percent *without an increase in piston displacement.*
- Increase gas mileage by five to 15 percent. That's as much as three miles per gallon.
- Spark a change in automobile styling that could drop hood lines by several inches, with an accompanying increase in visibility through the windshield.

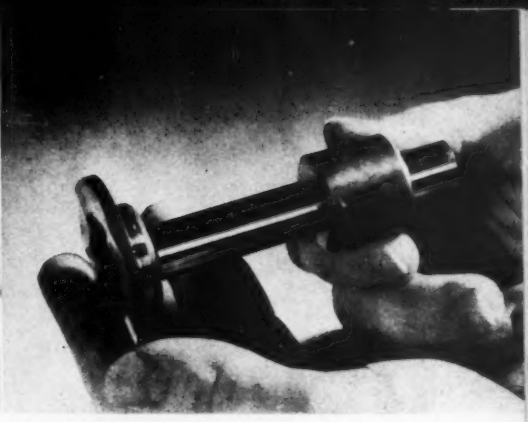
Fuel injection may be offered on some 1956 cars. More probably, it will come on 1957 models, out next fall. It's likely, in the beginning, to be an extra-cost option. The price should be in the neighborhood of that for power steering—maybe around $100.

Eventually the carburetor as an engine accessory will disappear. Fuel injection is that good. I know. I've driven a car equipped with it.

Silk-smooth. It whizzed away from a stop light. Unlike a carburetor car, this one had no "flat spots" in accelerating. It responded instantly to the gas pedal. Snubbed down by the brake to five miles an hour in high gear, it was silk-smooth, and this with a standard three-speed transmission. I got no back talk, no shud-



INSTALLED IN CAR, system requires much less space than a carburetor. Air cleaner is removed here to show throttles. One car fitted with experimental fuel injection is using 14 percent less fuel at speeds up to 60 m.p.h.



SOLE RECIPROCATING PART of injection pump is this plunger, which is a combination rotary valve, pump, and fuel distributor. Cam and roller shuttle it horizontally to pump, and to open or close some ports. Sleeve meters fuel.

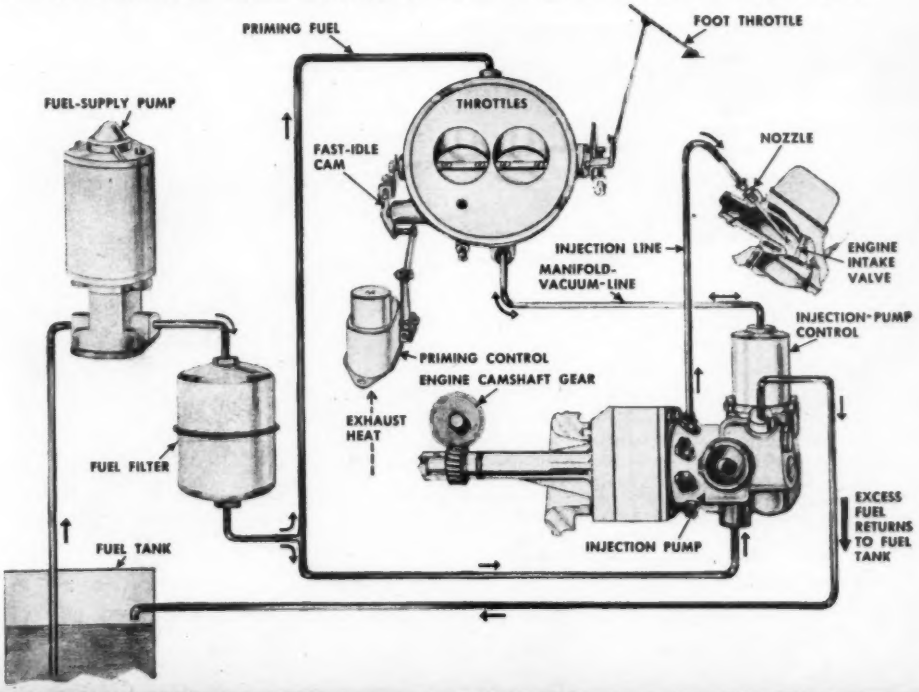
der, no bucking. At idle, the engine was so free of vibration that I had to tap the accelerator to see whether it was turning over.

This was an experimental car of popular make, owned by the American Bosch Division of the American Bosch Arma Corp. Bosch prefers that the car's brand name be withheld for the present —negotiations for wide sales of its fuel-injection system are under way in Detroit.

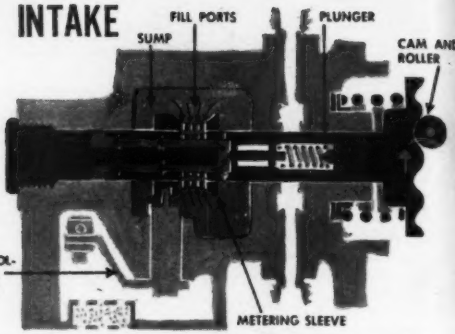
Fuel injection, at long last, will lay the ghost of the carburetor bugaboo that has plagued the gasoline engine since

Fuel-injection system has seven main parts

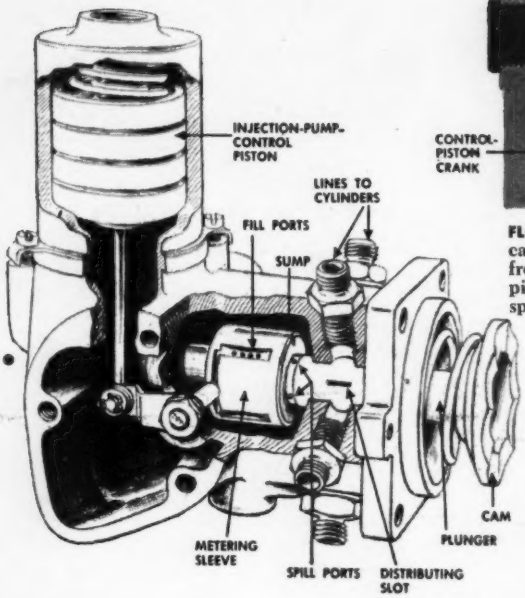
FUELING CYCLE starts at *throttles,* which admit air to intake manifold. Manifold vacuum governs *injection-pump control. Fuel-supply pump* feeds gas to *injection pump* through *filter. Nozzles* feed cylinders. *Priming control* supplies extra gas to manifold for cold-engine starts.



Injection pump has three-phase operation

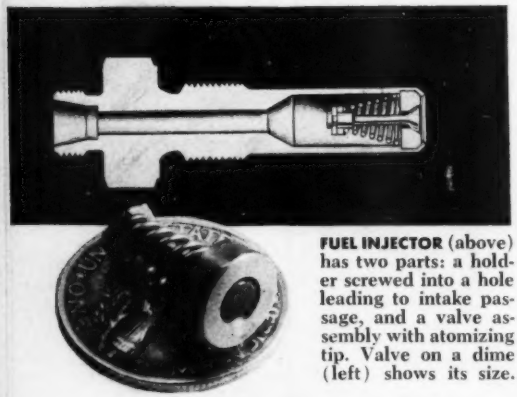


FLOODING THROUGH FILL PORTS—opened by cam and roller—in plunger and sleeve, fuel from sump fills interior of plunger. Control piston has positioned metering sleeve with respect to spill ports. As the plunger rotates . . .

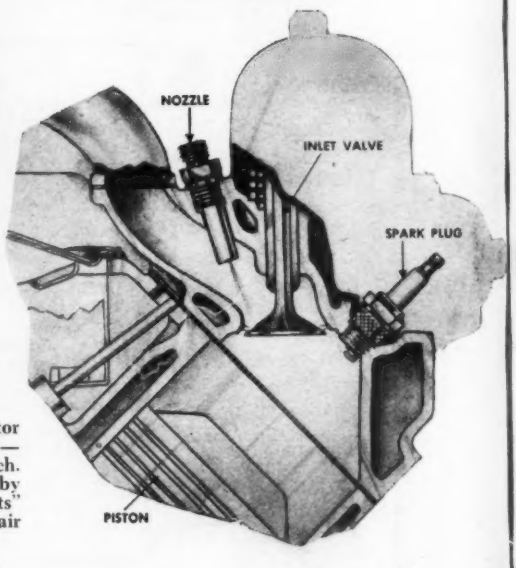


CUTAWAY OF INJECTION PUMP shows spring-loaded piston in "control," which responds to vacuum level in manifold, representing volume of air being delivered to cylinders. Through crank, piston moves sleeve on plunger to meter fuel and discard excess. For operation, see panel of drawings at top.

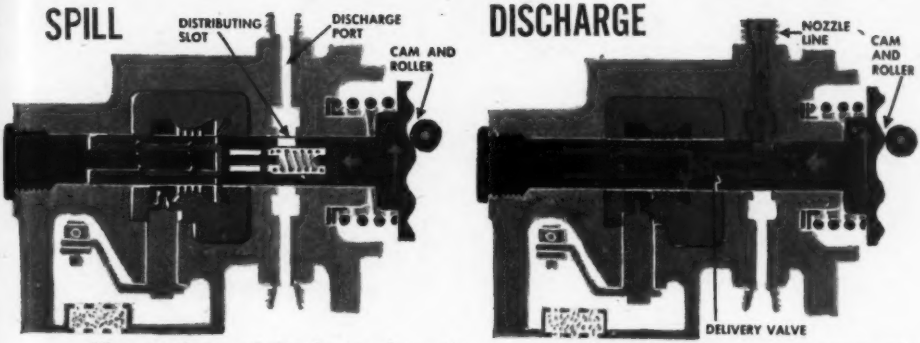
Tiny atomizers deliver cloud of fuel to each cylinder



FUEL INJECTOR (above) has two parts: a holder screwed into a hole leading to intake passage, and a valve assembly with atomizing tip. Valve on a dime (left) shows its size.



INSERTED BEHIND INTAKE VALVE (right), injector valve—of simple, outward-opening poppet type—yields at pressure of 70 pounds per square inch. Atomization of any quantity of fuel is assured by nozzle design. Having no guides, the valve "floats" in its assembly and is self-aligning. Incoming air and atomizing fuel serve to keep it cool.



. . . fill ports close, and distributing slot registers with one of the discharge ports to the nozzle line. Pumping stroke now starts, and excess fuel trapped in plunger is forced out through spill ports into sump. As cam . . .

. . . introduces third phase, sleeve covers spill ports and remaining fuel is forced through delivery valve out through distributing slot to nozzle line feeding cylinder. End of stroke completes injection. Cycle repeats for next outlet.

its invention. The basic difference in its design is that it separates two functions of the carburetor. A carburetor delivers air to an engine. It also delivers fuel vapor. It mixes the two and pipes them to the cylinders through the intake manifold.

A fuel-injection system delivers only air through the intake manifold and, separately, sprays fuel into the cylinders. Of all the components of an engine, the carburetor, where fuel and air are mixed, has been the zaniest part with which designers have had to cope.

Carburetion is always a compromise, even with the newest of the four-barrel jobs that try to accommodate the fuel-air intake to engine speed and load. It causes a fuel-wasting, excessively high idling speed. Vibration is inevitable in most engines if satisfactory performance at cruising speeds is to be obtained. And at top speed, cylinder starvation results.

Manifold limitations. The different cylinders in a carburetor engine never run at the same temperature. That's because fuel is never distributed to them in precisely the same amounts. The manifold system is too clumsy at metering it. At high engine speeds, the cylinders cry vainly for air. That's because the intake manifold must be just so big, and no bigger. If it's too big, the air moves too slowly and the gas vapor condenses at low speeds.

Carburetors require heat to vaporize the fuel before delivery to the cylinders. Heated air expands. That means that a lesser weight of it reaches the cylinders. So all sorts of dodges are used to maintain combustion, or "thermal," efficiency. These include ever-higher compression ratios, trick-shape cylinder heads and leaded fuels.

The carburetor has all these faults, plus a tendency to ice up. And it's the carburetion system that causes vapor lock.

Fuel injection automatically obviates all this.

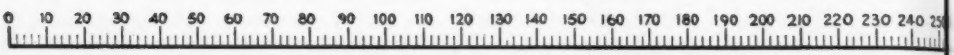
Abundant air, metered fuel. In a fuel-injection engine, the air comes from one source, the fuel from another. They are mixed inside, or just as they enter, the engine cylinders. The air is supplied in abundance. It's cool. It's dense. The fuel is metered in exact amounts, right down to a fraction of a cubic millimeter. Every cylinder gets a like amount.

With fuel injection, horsepower and gas economy go up because an engine extracts more zing from the fuel fed to it.

A car is peppier at take-off because better "breathing" shaves 500 to 1,000 revolutions off the r.p.m. at which the engine reaches its maximum torque, and

[*Continued on page 272*]

Auto Buyer's Score Card



Scale drawings give you dimensions, and tables cover the chassis, engines and transmissions of the new U. S. cars.

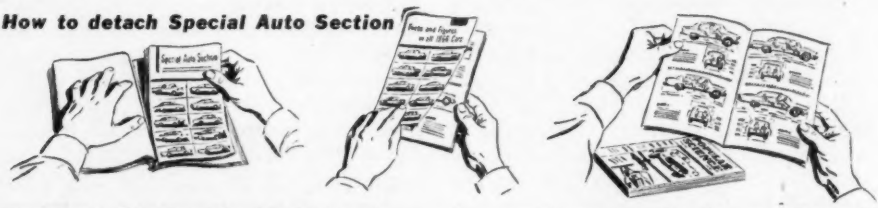
WHETHER it's the headroom in a Buick, the fuel requirement of a Studebaker Commander, or the radiator capacity of a Rambler that interests you, the detachable 16-page section that follows will give you the answers. These pages list detailed specifications and dimensions for 1956 U.S. passenger cars, prepared from data provided by the makers themselves.

Drawn to an identical scale (1 inch to 3¾ feet), the two-view drawings of 20 cars are marked with 22 of the most useful physical measurements of a car. But you can readily obtain other dimensions besides those that are lettered in. Simply measure off any dimension (in the plane of the view) that you wish, using a ruler, a pair of dividers, or simply two tick marks on a scrap of paper. Then lay the measurement against the scale that is printed across the center of each page of drawings and read off the actual dimension.

Some notes on the tabular data:

- **Prices are suggested factory retail prices, including Federal excise taxes but without state or local ones, for a four-door sedan with standard equipment.**
- **Basic transmissions listed are those so designated by the maker, even in cases where the majority of cars built in that particular series may be fitted with an extra-cost transmission.**
- **Weights listed are for four-door sedans, with standard equipment but without a supply of gasoline or water.**
- **Turning circles of different diameters to the right and left are averaged.**

How to detach Special Auto Section



THE NEXT 16 PAGES can be detached as shown, carried in your pocket, or filed for future reference. They have been attached to the magazine in a novel way to make this easy. You will find them jampacked with figures that you can cite when discussing cars with your friends.

Francis W. Davis, Inventor

"The Father of Power Steering"—that's what the Smithsonian Institution calls him—is shown at his roll-top desk in Waltham, Mass. A working model of a vacuum pump he built at 16 is beside him.

Mr. Power Steering's Ship Comes In

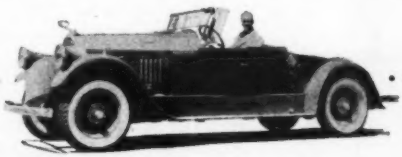
But he waited 25 years for royalties on the invention he demonstrated on a Pierce Arrow.

By Hartley E. Howe

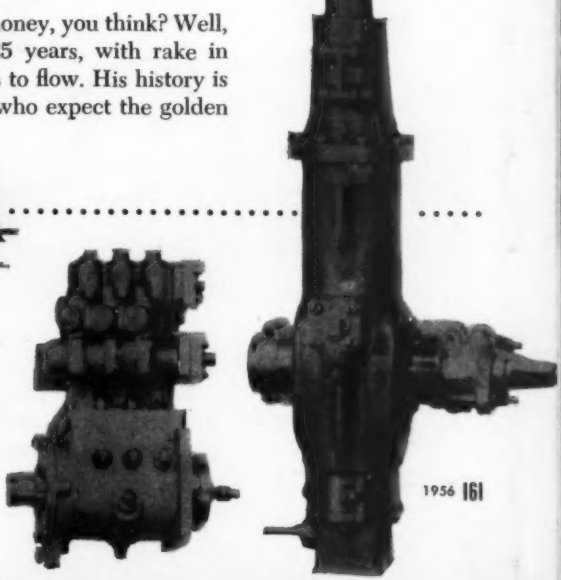
THIS year, Detroit figures, better than one in four new cars will be sold with power steering—more than 2,000,000 units.

That's a remarkable record for an accessory that did not hit the market until 1951.

Sounds like a good way to rake in money, you think? Well, power steering's father waited for 25 years, with rake in hand, before the royalties even *began* to flow. His history is instructive for inventors everywhere who expect the golden



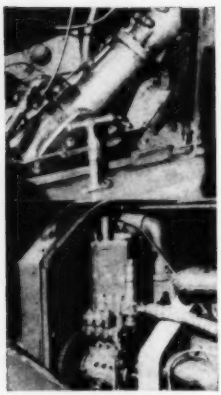
In this Pierce Arrow roadster Davis installed his first power-steering unit, drove to Detroit and demonstrated it to the automobile industry in 1926. At right are the elements of the same prototype unit—hydraulic pump (left) and steering gear—recently placed on display in Washington's Smithsonian.



shower to begin the moment that a patent application is filed.

Power steering was ready to go in 1926. This was a quarter-century before its first passenger-car sale. Today Francis W. Davis, the tall Yankee who invented power steering, can afford to be philosophical about that quarter-century of disappointments and frustrations. Currently, more than half of the power-steering units manufactured are licensed by him. But philosophy was about all he had to nourish his hopes in the long years during which his patents aged fruitlessly.

Power Steering: the Pioneer Unit



Original hydraulic steering gear (upper photo) and its large engine-driven pump are shown in Davis' Pierce Arrow.

Davis was confident in 1926, when he set out for Detroit in his Pierce Arrow roadster from his home in Waltham, Mass. Beside him was George Jessup, a highly skilled designer and toolmaker who had turned Davis' idea into precisely fitted metal. Under the Pierce's hood was an exciting new power-steering mechanism. Ahead was a market, ready to be captured.

Davis was not unknown in Detroit. He had gone to work for Pierce Arrow after being graduated from Harvard in 1910, and had risen to chief development engineer. He was highly regarded in the Motor City. In 1926 he was an independent consultant, a man who knew the ropes.

His invention, moreover, was no baling-wire lashup. It used hydraulic pressure, something that had interested Davis ever since he had investigated a truck lift invented by a struggling mechanic named Gar Wood. The heart of his steering mechanism, covered by one of his two pending patents, was an "open center" valve. Whenever the driver turned his steering wheel, the valve diverted pressure against a piston that moved the front wheels.

Idea Factory

Inventor (right) and assistant, outside shop where they have worked since 1922.

His other patent application covered a way to prevent oversteering. When the driver turned the wheel, he had first to overcome the resistance of a little spring before the valve could move. Today, this spring is what differentiates "when needed" from "full time" power steering.

In a whirlwind tour of the auto companies, Davis and Jessup saw 26 engineers in 10 days. Each engineer was enticed into driving the Pierce Arrow himself, to see that the big car could be steered as easily as a bicycle. All of them were impressed with the new device, and they said so.

The General Motors men were the most enthusiastic. Engineers from the Saginaw Division, which made GM steering gears, thought that power steering might be a natural

for Cadillac. And when a one-year option was taken early in 1927, Davis felt that he was in.

But development turned out to be an interminable business. The device had to be fitted to the Cadillac engine. Bugs had to be worked out in long test programs. Parts had to be redesigned to reduce costs and simplify assembly.

Disaster nearly sank the whole project once. Davis glanced under an experimental power-steered Cadillac in which GM's Boss Kettering and some other top brass had just been zooming around the test track. A tie rod underneath didn't look right. Taken off, it proved to be cracked almost through—so weak that Davis easily snapped it across his knee. The defect had nothing to do with power-steering, but it was a close thing: Davis knew that a headline-making smash could well have destroyed his hopes.

GM's option was renewed each year as development ground slowly on. While making his living as a consultant, Davis worked in his spare time at trying to add road feel to his steering system. He finally hit on a trick of bleeding off some hydraulic pressure to *oppose* the movement of the steering valve, an amount that varied with changing road conditions.

"Hydraulic reaction" was developed in 1931, the same year that Davis received patents on his open-center valve and centering spring. By this time Cadillac was ready to offer Davis a four-year agreement guaranteeing him a small annual minimum payment. But the inventor thought that the GM patent lawyers were hard bargainers. After several days of haggling, Davis put on his hat and walked out. Half an hour after he reached his Detroit hotel, the phone rang. "You win," said the GM lawyer. "We'll sign it the way you want it."

By 1933 a power-steering unit in one of Cadillac's big 12-cylinder jobs was working fine. The time had come, the engineers said, to go into production.

But the brass disagreed. The depression had set in like a cold wave and production would probably be less than 15,000 Cadillacs in the coming year. Spread over so few units, tooling costs would push the retail price of power steering so high that the public wouldn't buy it. Production plans were called off and GM asked Davis to give up his guaranteed minimum payment. He refused, and 1934 found the inventor right back where he had started, looking for a customer.

It took two years to find one. Then Bendix signed up with Davis. But Bendix built no cars itself; it made parts for others

Doer and Thinker

Davis (right) with George W. Jessup, master machinist, who has been translating the inventor's ideas into metal for a third of a century

—on order. By 1939 Bendix had produced exactly 10 power-steering units and sold two of them, mounted on trucks.

Meanwhile, Davis stuck to earning a living—and improving power steering. In 1941 he patented a lighter and more compact method, called "axial movement," to make the steering wheel close the hydraulic valves. The lower end of the steering column is threaded to mesh with gears. When the column is turned, the initial resistance of these gears makes the column move in or out slightly, like a bolt in a threaded hole. It is this motion—only .060 inch—that Davis harnessed to close the valve.

Power-Steered Chevrolets, 1940

These Chevrolet armored cars, built for the British in 1940, were the first vehicles to go into production with Davis power-steering units.

In 1940 Buick had bought and installed three power units. They worked fine and costs were figured and okayed. But before marketing could get under way, power steering was dealt a second body blow. Civilian auto production, with or without power steering, went out with Pearl Harbor.

Military needs, however, gave Bendix and Davis substantial orders. Already the British Army had ordered them to go into Chevrolet armored cars. The American forces put in a similar order. Other units went into huge tank-recovery vehicles, which were heavy and hard to steer.

With power steering tested on the battlefield, Bendix was able to find off-the-highway markets for it when peace came. Units went into huge earth-moving and track-laying vehicles. Others were adapted to farm tractors, so that even the kids could plow.

Davis demonstrates a recent invention: a suitcase designed for do-it-yourself portering.

Davis, however, was still after big game—the passenger-car industry. But at Buick he found that the three cars with power steering had disappeared. So had the executives familiar with power steering. Their successors were not interested in his idea.

The general reaction went something like this: Sure power steering's good. But we don't want it—not now, anyway. In the first place, our competitors don't have it, so we don't need it to keep up. Besides, this looks pretty complicated—who knows what hidden maintenance problems might turn up? What's more important—let's face it—we're selling all the cars we can make right now. Why should we invest millions in new tools?

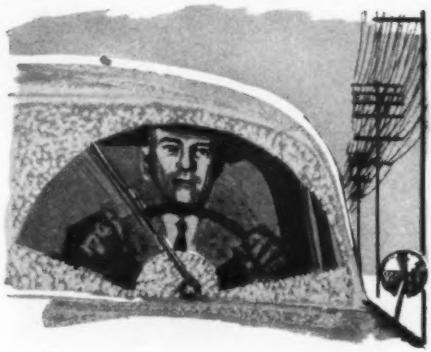
In 1948, Davis' original 1931 patents ran out and the basic principles of his power steering were open to everybody. Fortunately for him, however, the axial-movement patent, taken out in 1941, still remained to give Davis units a

[*Continued on page 270*]

New Ideas
FROM THE INVENTORS

1 Truck to Stow Its Cargo. Instead of carrying cartons into this truck, loaders would stack them on a pallet that would roll on rails recessed in the floor. Unloaders could push each flat pallet, with its cargo, back to the door. The empty flats, stacked endwise along the wall, could be moved toward the door and lowered for loading.

2 Wiper Blade to Scrape Sleet. This stiff-edged scraper would clip around a windshield wiper blade and could be slipped off quickly when it wasn't needed. It would be made slightly narrower than a standard blade so that the rubber edge would stick out a little and bear against the glass brushing away scraped ice.



3 Fan Muffler To Hum You to Sleep. Blowing through this porous muffler, an ordinary electric fan would sound, according to the inventor, like "the sighing of wind through trees." The pleasant, regular drone, he says, would help you fall asleep. It would also drown out sleep-destroying noises of traffic, neighbors, cats, and dogs.

Please turn the page for more new ideas

MORE New Ideas from the Inventors

4 Shoes to Warm Your Feet. You couldn't blame cold feet on the weather if you had a pair of boots like this. Side opening compartments would be provided in the soles for the kind of chemical that gives off heat when wet. By adding a few drops of water now and then, you could keep your feet warm during a day outdoors.

5 Bench to Hide or Hold Ironer. It would be difficult to turn an ironing board into a handsome piece of living-room furniture. This design, however, would hide the board inside an attractive, lift-top bench. Short, collapsible legs—and the bench itself—would form the work stand when the ironing board was set up.

7 Train Sign to Call Stations. Passengers wouldn't have to scurry to get off a train if signs and loudspeakers announced each station a few minutes before arrival time. A tripper for the film-strip signal mechanism would be geared to an axle of the car and thus synchronized with the distance that the train had traveled.

6 Dial to Show Wheel Direction. A driver might find it easier to get in or out of parking spaces if he could see which way his wheels were pointing. Linked to the steering gear through a flexible cable, this device would show wheel position on a dashboard indication. It could be factory-installed or attached to present cars.

8 Bell to Tell When You're Out. Normally this button would ring a doorbell in the usual way; but when you went out or just didn't want to be disturbed, you'd switch off the bell. Pushing the button then would light a sign telling visitors you were not at home. You could set a dial on the sign to announce the time of your return.

9 Electric Steamer to Peel Paper. With this wallpaper remover you wouldn't have to pipe live steam to a wall or grapple with a hand-held steam tank. Cold water, piped from a separate tank, would be sprayed through an adjustable nozzle. The electric faceplate of the peeler would turn the spray to steam right on the spot.

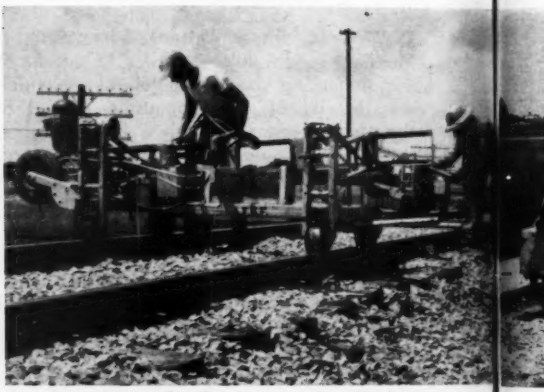
U.S. patents on these inventions have been granted to: 1. Alfred M. Gildersleeve, Brooklyn, N. Y.; 2. Samuel N. Kagan, Detroit, Mich.; 3. Max H. Leavenworth, Dallas, Tex.; 4. Edward T. Behner, Cleveland, Ohio; 5. Solomon B. Raduns, New York City; 6. Robert H. Brink, Newark, Del.; 7. Benjamin B. Kirby, Kansas City, Mo.; 8. Mario G. Lazzari, Bergamo, Italy; 9. Jerral E. Lawton, Buffalo, N.Y.

Mechanized Section Gang

Track machines renew ties on the Santa Fe.

THERE are approximately a billion crossties on America's railroads. And while a creosoted tie lasts 30 years, or roughly three times as long as the rails above it, at least 33 million ties must be replaced each year to keep main lines, branches and yard tracks up to par. To do the job costs more than $150,000,000: $3 for each tie plus $2.15 for labor if the tie is installed by hand.

There isn't much that the railroads can do about the cost of ties. But to whittle down replacement bills they are



1 SPIKE PULLER heads the parade. Working like a huge pair of pliers, its hydraulic pulling tool can be swung over either of the rails.

4 TIE BED DIGGER cleans out the cement-hard ballast after the tie has been removed, deepening the trench for a new and heavier tie.

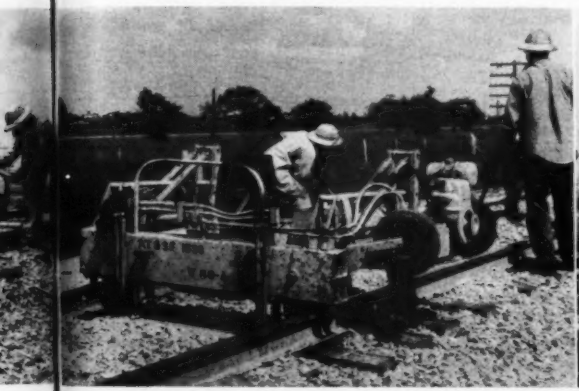
5 TIE INSERTER uses a cable and butting plate to shove the new tie into place after the end ballast has been cleared out by hand.

Now Lays Railroad Ties

working with equipment manufacturers to develop fleets of small, single-purpose machines that will do the work faster, better and cheaper than the old-time section gangs. To make good, the equipment must be highly mobile, husky, easy to operate, and inexpensive to maintain.

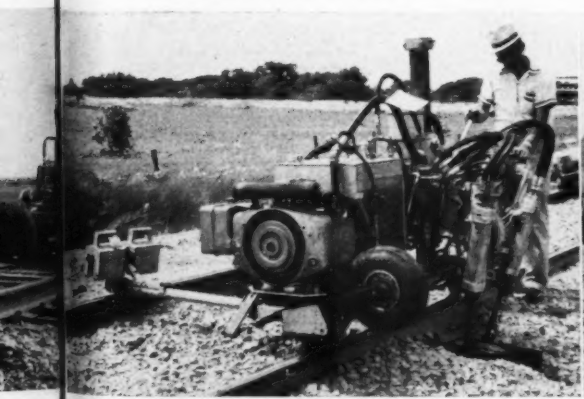
The robot trackworkers shown here are among the most efficient yet built. Manned by a team of 31 specially trained Santa Fe maintenance-of-way workers, they whisk out old crossties and shove in new ones at a cost of 93 cents a tie—a saving of more than half over the hand-jack, ballast-fork and spike-maul method.

Any one of the machines can be lifted on or off the rails by one man or two, and each member of the crew knows how to operate all seven. That means that manpower can be concentrated on any part of the work that lags, preventing the fleet from bunching up. An outfit like this can remove and replace 125,000 ties a year—or enough to completely re-lay 47 miles of track.—*Henry B. Comstock.*



2 RAIL LIFTER locks onto both rails and hoists them clear of the tie plates, hydraulically. With the plates removed, the tie is freed.

3 TIE REMOVER now goes to work. Gripping the rails, it pushes the tie out by applying three thrusts with a prong-tipped ram.



6 MULTIPLE TAMPER next compacts the ballast under the tie. Two machines are used, one to work on each side of the track center.

7 SPIKING CARRIAGE. Tie plates must be inserted by hand, after which air hammers on this air-compressor drive in the spikes.

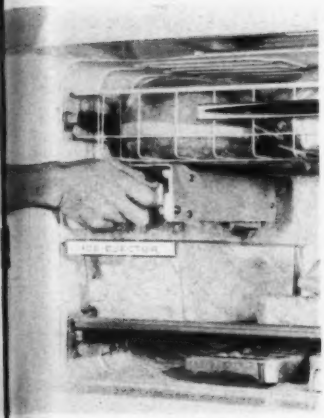
New for Modern Living

1 Insulated vest permits unrestricted arm movement for active outdoor work or sports. A vinyl-foam lining keeps out wind and cold, and an extra long cut at the back lends added protection. Light and buoyant, the lining is said to keep the wearer afloat in case of any accident on the water.

2 Cold oven cooks with microwaves. If you'd like to invest $1,200, you now can have most of your cooking at home done in a cold electronic oven. It works by ultra-high-frequency waves of the kind that transmit television pictures. They cook food without heating the oven walls or the dishes in which it is prepared. The oven is fast, too. You can broil bacon on a paper plate in two minutes, bake a cake in six, and cook a five-pound roast in half an hour.

3 Automatic davenport unfolds like a convertible top. A push button starts a hydraulic pump linked to cylinders at the pivot arms, to open or close the bed. There isn't enough pump pressure to fold up the bed while you're in it, nor can the sofa be opened accidentally if anyone is seated on it —instead, a fuse blows out.

Further information about the products described on these pages can be obtained from: 1. Olive Lucena, 526 Front St., Lake Linden, Mich.; 2. Tappan Stove Co., Mansfield, Ohio; 3. United States Bedding Co., St. Paul 14, Minn.; 4. Frigidaire Div., General Motors Corp., Dayton 1, Ohio; 5. Zenith Radio Corp., 6001 W. Dickens Ave., Chicago 39, Ill.; 6. Bell Electric Co., 1844 W. 21st St., Chicago 8, Ill., 7. Precision Products Co., Cupertino, Calif.; 8. Kelvinator Water Coolers, 265 N. Hamilton Rd., Columbus 13, Ohio.



4 Ice ejector in the freezer of this refrigerator forces ice cubes out of the tray when it's pushed in upside down. Cubes drop into a storage bin below, which holds up to five pounds of ice. The temperature of the freezer keeps the cubes from sticking together while stored in the bin.

5 A throbbing alarm is built into this watch. A stem above the winding stem sets it. At the hour set, a tiny hammer striking a pin causes the back to vibrate against the wearer's wrist. The watch was designed for the hard of hearing, but it could be used as a silent alert by anyone.

6 Clamp-on outlet with extension cord brings power to tables, workbenches, barbecue carts and other metal-based equipment with round or angle legs. For safety, a cap over the outlet must be turned to admit the plug; it snaps shut automatically when the plug is removed.

7 Electric scissors cut smoothly without effort by just being run through the material. Plug them in, press the starter button, and the blades snip through thin or heavy fabrics in fast, straight lines or slick curves. The shockproof plastic case fits snugly in the palm of your hand and a six-foot cord gives you plenty of room for cutting out a dress without having to shift the work.

8 Dual fountain. Here's a water "cooler" that dispenses piping-hot water, too—for the coffee break and the lunch hour. A built-in water heater heats the water to just the right temperature for making coffee, tea, chocolate or instant soup. A full tank can serve up 20 cups of steaming water at once, and heat up more at the rate of 40 cups an hour. Two gallons per hour are cooled.

Gus and the Ninety-Day Wonder

By Martin Bunn

"I JUST can't figure it out, Gus," Johnny Carter said mournfully. "This was one of my A-1 cars. Had a new-car guarantee. In fact, it *was* as good as new when it left my lot. But he's claiming all over Capitol City that I cheated him—sold him a lemon."

Gus looked thoughtfully at the young car dealer. "Did you give him free service for 90 days?"

"I would have, but he didn't bring it in until the ninetieth day, and then he just wanted it winterized. I put in winter-grade oil, tuned it, and put in antifreeze. I even wired a little tag to his radiator hose showing how much antifreeze I had put in and that it was good for 30 below—that's one of my little service courtesies."

"What's the matter with his car now?" Gus asked.

"It skips. It went for about 10 miles after I serviced it and then it began to miss. There's a short in it somewhere, and neither my mechanic nor I can find a thing."

Gus said consolingly, "There *are* cars like that, Johnny. Maybe it *is* a lemon. It's not your fault."

"Gus, you don't understand." Johnny Carter ran his fingers through his rumpled hair. "When I got out of the service, my one ambition was to have an automobile agency of my own. I took every cent I had and put it into this used-car lot, hoping to make enough money and a good enough reputation so that I could have the new auto agency everybody said was due to be started in Capitol City." He stopped for breath.

"But selling one lemon isn't going to ruin your whole career, son," Gus said.

"Oh, isn't it? The guy I sold it to is the brother-in-law of the man who allots franchises in this part of the state. He can make me or break me."

"Why not buy the car back from him for just what he paid for it?"

"That's what Gruntzman wants me to do. In fact, he's insisting. He says I had it rigged so that it would run for 90 days and then, blooey! He calls the car the Ninety-Day Wonder."

"Gruntzman," Gus mused. "Where have I heard that name before?"

"Only every other hour on station WCAP," moaned Johnny. "He's Grunny Gruntzman of Platter Parade, the disc-jockey show. That's him now!" Johnny indicated the music that was coming from the back of the Model Garage.

The music stopped and a voice came through the loudspeaker.

"DO I seem a little out of breath, guys and chicks?" The voice made Gus think of maple syrup that had been carbonated. "I've been running," the voice went on. "I started for work, like I always do, in my Ninety-Day Wonder, and like always it began skipping and coughing. So I had to push it all the way to the studio." In the background there was a peal of laughter from some studio guest. "It tried to turn in at the lot

"Now," said Gus, "if you people will step back, my little expert will go to work."

where I bought it, but I won't let it go home until the jerk that sold it to me gives me my money back. I wonder who he'll sell it to next?"

Johnny ground his fist into the palm of his hand.

"It won't be long before everybody in Capitol City knows who he's talking about. I'll be ruined."

Gus put his hand on Johnny's shoulder. "Son, we've got to prove he's wrong and make him eat his words. You tell him to bring his Ninety-Day Wonder in here."

"I'll do it, Gus. Thanks a lot!" Johnny waved from his car window and was off down the road toward Capitol City.

Gus looked at his watch. It was six-thirty. He walked to the washroom at the back of the shop. As he passed Stan Hicks, he said, "Can you hold the fort until closing time? I'm going to the inter-city basketball tournament with Red Plummer." Red was sports editor of the Capitol City *Times*.

"I wish to report an accident."

Stan whistled. "Free seats again, Gus? Boy, it sure pays to have friends in the newspaper business."

The next afternoon Johnny Carter was back again. His face was long. "He won't come," he told Gus. "He just wants his money back."

Gus filled his pipe thoughtfully. "Let me get a couple of things straight, Johnny. Gruntzman had no complaints about the car during the 90-day guarantee period."

"Right."

"He brought it in to have it winterized on the day the guarantee ran out. Was that just a coincidence?"

"I think so," Johnny said. "He liked the car up to that time."

"You tuned the car, changed the oil and put in antifreeze. Right?" Johnny nodded. "And you tied a card saying how much antifreeze you had put in and what temperature it was good for on the radiator-hose connection."

"Most service stations don't do that," Johnny admitted, "but I thought people might like it."

"Good. Now you run along. I've got a couple of phone calls to make."

THE result of Gus's first call appeared in the Capitol City *Times* the following morning. It was a small advertisement: "I specialize in fixing Ninety-Day Wonders." It was signed: "The Model Garage, Gus Wilson, Prop."

The result of another phone call appeared as the first paragraph in the column, "Red Plummer Looks At Sports":

> As readers of this column know, our motto is: "If you can't be an athlete, be a good sport." A certain radio disc jockey has been making jokes about his Ninety-Day Wonder, a car he bought from a local second-hand-car dealer. That may be fun for the disc jockey, but it's pretty hard on the man who sold him the car. There is an advertisement elsewhere in this paper by a man who specializes in fixing Ninety-Day Wonders. Do you suppose this certain disc jockey will accept his invitation? Do you think he really *wants* his car fixed?

Gus turned to Stan, who had been reading over his shoulder.

"Let's hear what the opposition has to say." They walked to the back of the shop and turned on the radio.

A voice faded in. It was Grunny.

"—but your friend Grunny isn't going to take this lying down. No, sir! I'm going out to this Model Garage this afternoon—"

Gus chuckled. "I knew that needle Red Plummer gave him would pay off."

"—and I've arranged for WCAP's mobile unit to accompany me—"

Stan looked at Gus, eyes widened.

[*Continued on page 252*]

How to Build a Rotary Tiller

The toughest part of the machine comes ready-made; powering it with the engine from your lawn mower cuts cost way down.

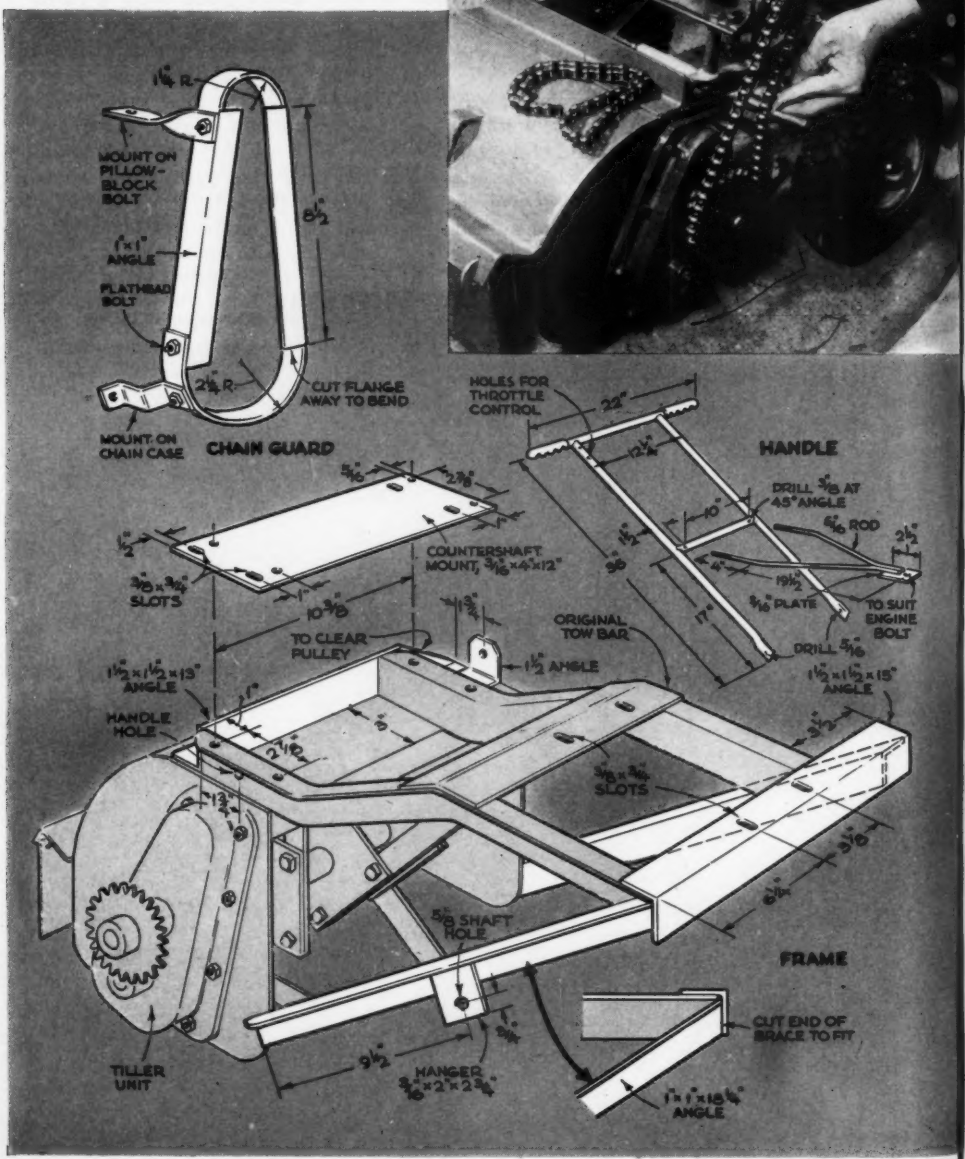
By Howard G. McEntee

RIGHT around home you may already have half the makings of a rotary garden tiller. The engine of a gasoline lawn mower can be worked double shift to cultivate your garden as well as cut the grass. Switching it from mower to tiller, or back again, should not take more than 10 or 15 minutes.

This two-for-one deal saves you the cost of a separate engine, and may put a tiller to work for you at just about half the price that you would otherwise pay. Nor need you be a mechanical whiz to build the machine; the most difficult

Tiller rotor is driven by a chain from the countershaft

PURCHASED TILLER and H-shaped tow bar are shown shaded in the drawing below. Pieces of angle iron are welded on to support the engine, wheels and countershaft. Adjust chain tension to leave ½" of slack as at right. If slots do not give enough adjustment, put washers under the spacers. Adjust V-belt tension by moving the engine backward or forward on its mounts.



Housing and rock guard protect the user

BOXLIKE TILLER HOUSING has a reduction unit with a 24-tooth sprocket mounted on its side. In the photo above, the tow bar, crosspieces and braces have been welded on, but countershaft is not yet in place. A hinged rock guard (at left in above photo) shields the user from flying dirt and stones. The machine propels itself; effort is required only to hold it back or guide it over the ground.

parts of it are available already made up.

These are the tiller-head components—the shaft and tines that stir up the ground. A national mail-order house sells a 12″ head as an accessory for a small garden tractor.* Costing about $37, it is a well-made, neatly housed unit with hardened tines, good bearings, a built-in chain reduction and a rock guard. The tines are replaceable.

If your mower engine has a centrifugal clutch and you put 1½″-wide wheels on the tiller, the total parts cost will run about $52. (The tiller shown cost more because it has heavy-duty 2½″ wheels. These make it easier to handle in soft soil, but are by no means a must.) Welding will run four or five dollars if you don't do it yourself, but will still leave the total cost well below that of a comparable commercial machine.

Use all the pieces. With the tiller head you get a drive chain and an H-shaped tow bar for coupling to the tractor you haven't got. Both will be useful.

A boxlike angle-iron frame, to which the tow bar is meant to be bolted, is welded atop the tiller housing. The first thing to do is "unweld" this. Make center-punch marks along the weld beads, the diameter of a 3/16″ drill apart. Run a drill that size in at 45°, just to the surface of the housing. Then use a diamond-tip cold chisel to cut through between the holes. Discard this frame.

Cut a piece of 1½″ angle iron to span the full width of the housing, long enough to be welded to the ends as well as to the top. At one end, cut the vertical flange at a slant to clear the countershaft pulley.

Drill the top of the H frame for bolts to hold the countershaft mount. In the vertical flange of one frame leg, drill a hole for a handle bolt. The other handle mount is a 2″ length of 1½″ angle welded at the end of the housing.

The front crosspiece, a 15″ length of angle, projects past the H frame on one side to line up with the housing.

Check your engine. This front crosspiece and the crossbar of the H frame form the engine mounts. The slots shown fit a Model 6 Briggs and Stratton engine; for others, minor changes may be needed.

By careful fitting and the use of extra brackets you could bolt the parts together. But welding makes the job

**Various attachments of this kind can be adapted. The drawings and construction methods described relate to Montgomery Ward's rotary-tiller attachment No. 87-5086 for the Til-Trac garden tractor. Semi-pneumatic 10″-by-1.75″ wheels are available from various mail-order dealers at about $1.65 each.*

easier and results in a far stronger structure, with no bolts or rivets to work loose from vibration.

If you have the welding done outside, be sure to cut, drill and fit all parts beforehand. It's smart to clamp them up in a trial assembly. Scrape paint off the tiller head where welds are to be made. Remove the chain case and gasket so that welding heat will not damage the latter.

Wheels. Some commercial tillers have no wheels. But wheels give easier control of working depth, and facilitate moving the machine, especially over paved areas.

You can buy 10" rubber-tired wheels with a 1½" tread for less than two dollars apiece, or a metal-tired type made for wheeled garden tools for even less. For 10" wheels, weld the shaft hangers into the braces as shown in the drawing. For other sizes, locate them so that the engine will be level when the bottom of the tiller housing is about 1" *beneath* the soil. With the tines on a hard surface, the engine will slant forward. (As some will stall in this position when the fuel is low, it is important to have the engine nearly level in the working position.)

The drawing on the facing page shows the axle turned down and threaded at one end. You can, instead, use a shaft collar at both ends, and so avoid machining. Be sure to use the felt seals shown if your wheels have ball bearings, to keep grit out of them.

The power train. It takes considerable torque to spin the tined shaft; an over-all reduction of about 1:16 is required with a 1¾-horsepower engine. The reduction built into the tiller unit has a ratio of about 1:1.5. With an 8" pulley on the countershaft, the V-belt drive from the automatic clutch of the engine shown gives a 1:4.4 reduction. A 10-tooth sprocket on the other end of the countershaft drives the 24-tooth sprocket on the tiller head at a 1:2.4 ratio. Multiplying all the figures on both sides of the colon shows the over-all ratio to be 1:15.84.

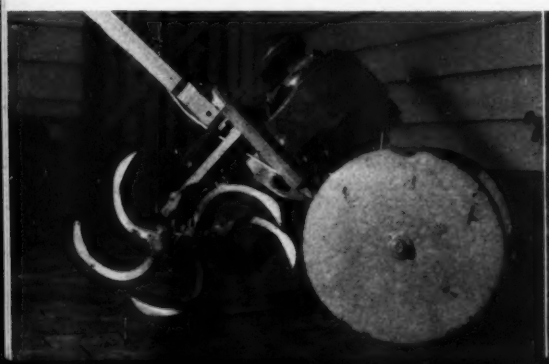
If your engine does not have a centrifugal clutch, you can install one or rig a belt-tightening idler controlled by a flexible cable. This is cheaper, but the centrifugal clutch is handier, giving you full control by use of throttle alone.

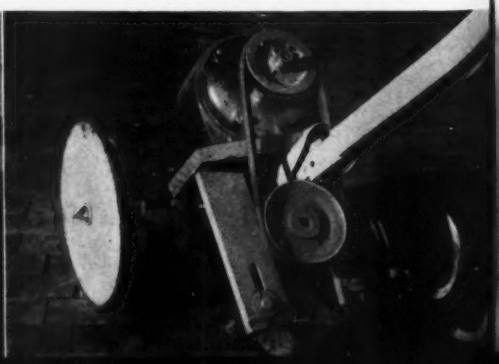
Mounting the countershaft. A 3/16" steel plate is mounted on the tow-bar legs with long bolts and spacers. Cut the spacers from ⅜" pipe, taking care to get them all the same length. The bearings are bronze-bushed pillow blocks. Slots

A ¼-Hp. Motor Drives This Light-Duty Electric Tiller

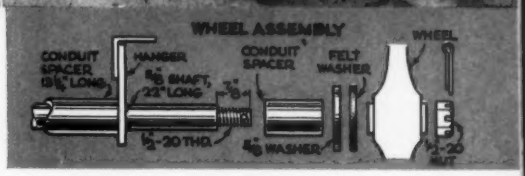
WANTING a light-duty rotary tiller, Everett M. Cronk of Ardsley, N.Y., made this electrified one. A V belt from its ¼-hp. motor drives what was once the wringer power take-off on a washing machine. Tines from a hand garden cultivator were fastened directly to the output shaft of this reduction unit, flats being filed on the shaft to key the tines securely to it.

A wooden motor platform is mounted on two slotted posts, which can be slid up or down to adjust belt tension. The handle is from a lawn mower, the wooden wheels from discarded lawn furniture. Because the action of the offset tines tends to turn the machine, the builder plans to relocate the transmission to bring the tines closer to the centered handle. He also suggests using a smaller pulley on the motor shaft instead of the one shown, to further reduce rotor speed.





Wheels can be put inside for cultivating close-set rows



WHEELS ARE HELD ON either with a collar at each axle end, or with a collar at one end and a nut at the other, as in the drawing at right. Cut dust seals from ⅛″-thick soft felt. For narrow-row cultivation, use a 15″ axle, a spacer to fit between the wheels when they are inside the engine-support frame (above right) and felt seals on both sides of the wheel hubs.

for the mounting bolts allow these to be slid forward or back to adjust chain tension. Make sure that the shaft turns freely after all the bolts are pulled tight.

The sprocket is best held on the countershaft with a taper pin. A setscrew will secure the pulley provided you drill a dimple in the shaft for it to seat in.

Both for your own safety and to keep sticks and gravel out of the chain, a guard should be fitted. Cut one flange off 1″ angle iron where it is to be bent to a radius, as shown in the drawing on page 176. Use flathead bolts, with the heads countersunk inside the guard, to join the ends and attach mounting brackets, one above, two at the lower end.

Handle is brazed up. Cut ¾″ electric conduit for the handle parts. Remove the zinc coating with abrasive cloth where the brazed joints must be made. Flatten the lower ends before drilling them for the 5/16″ mounting bolts.

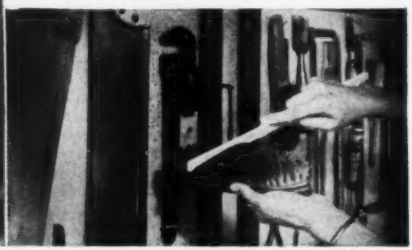
The bracing fork consists of two pieces of 5/16″ rod bent, threaded and brazed to a 3/16″ plate. This is clamped under one engine-head bolt. With a nut on each side of the handle crossbar, the fork can be adjusted to raise or lower the handle to convenient working height. Bolt the throttle control within easy reach and slip bicycle handgrips on the top bar. END

FURROWING GUIDE, provided with tiller head, can be set to hold tines at desired tilling depth, or it can be reversed with the hook forward as above. In this position it holds the machine back for deep cultivating or plowing.

Fast Spatter-and-Wipe Technique Kid-Proofs Tool Board

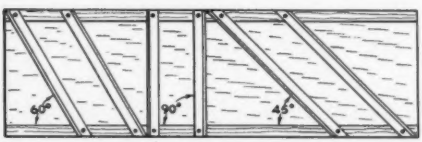
I HAD a hard time getting my youngsters to return my tools to their proper places until I spatter-painted the tool board this way, leaving the outline of each tool in its correct position. The spatter method is faster than painting on the outlines and gives a pleasing appearance to the board.

Dip an old scrub brush into a shallow tray of bright paint and draw a stick toward you across the bristles to fling the specks on the board. Cleaning up the spattered tools is quickly done with a cloth soaked in solvent.—*Bob Gilmore, Sonoma, Calif.*

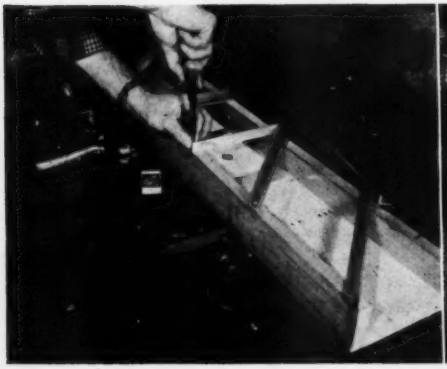


Tracks Guide Portable Saw for Cutting Automatic Angles

THREE pairs of rails let you cut accurate 45°, 60° and 90° angles with a portable electric saw. Cut the rails from a length of ¾" aluminum angle and screw them to the top of a wood trough made to suit the depth of the saw blade and the width of stock that you want to handle.

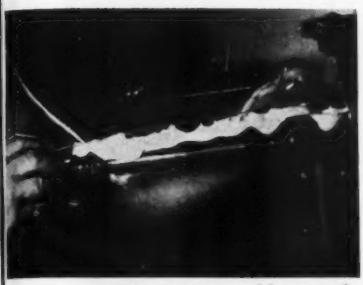


Lay out the rails as shown in the sketch to produce the desired angles, and space them so that the saw's shoe plate slides easily in between. Countersink the screw heads flush with the rails. The first saw pass will slot the sides of the box for use.—*Phil McCafferty, Stanwood, Iowa.*

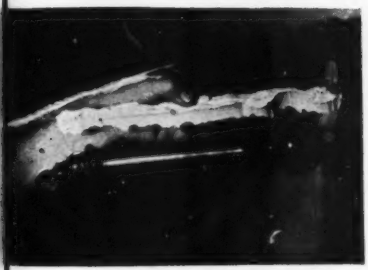


Plaster Casts Make Perfect Templates

PLASTER IS BUTTERED over the side of the model coated with protective petroleum jelly.



EMBED WIRE to add strength, then cover with a second, heavier layer of plaster.



LIFT THE TEMPLATE OFF carefully after the plaster sets, usually in about 10 minutes.

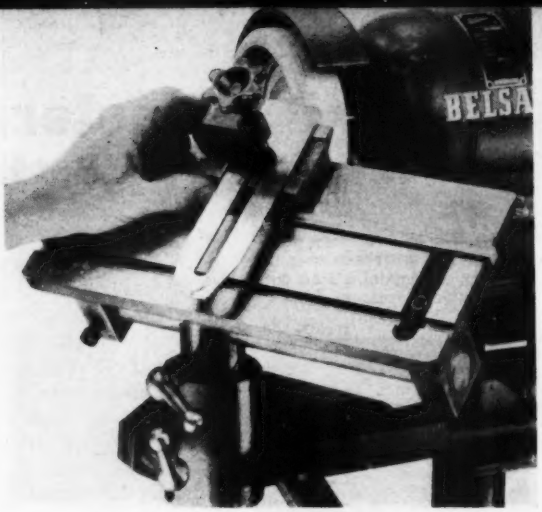
CUTTING a cardboard template to match the profile of a turned chair leg or some other irregularly shaped object is a tough, trial-and-error job. It is often easier to make templates out of plaster-of-Paris, shaping them directly over the original parts that you want to copy. The plaster flows into small cracks and curves, accurately reproducing fine details.

The plaster is mixed with water to a butter-like consistency and spread along a narrow section of the model's profile, about 1″ to 2″ wide depending on length. On long templates, you can embed a reinforcing wire down the center as shown. When the hardened cast is removed, saw off the rough edge on each side, leaving a center strip from ¾″ to 1″ thick. Applying shellac will give the plaster a hard, smooth surface and prevent details from chipping and crumbling.

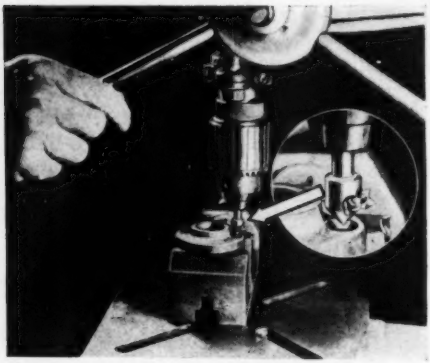
To make a duplicate lathe turning, you can use a cast to lay out the initial cuts, then keep fitting it to the work until the two shapes mate perfectly. If you want to make full-size drawings or other templates, you can also use the cast as a drawing guide, tracing the contours with a pencil. The templates can be stored indefinitely and will not become worn or dog-eared as cardboard may.—*J. M. Finn, Pittstown, N. J.*

HARDENED PLASTER becomes a permanent template, tougher than cardboard, for accurate checking of contours.

New Tools

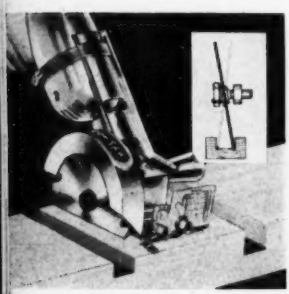


1. Sharpener Handles Wide Range of Tools. Work table and tool guides are part of a universal sharpener for workshop, garden and household tools. The 6″-by-14″ table adjusts to various angles and heights. A ¼-hp. double-end motor, grinding wheel and floor stand are included with the unit.

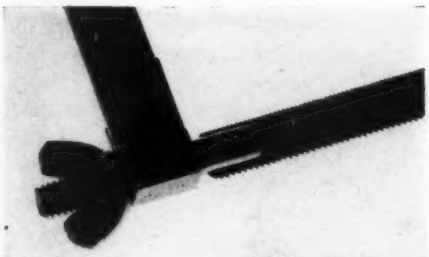


2. Countersink Ejects Chips. This countersink clears its own waste through a hole in the cutting edge, thus eliminating chatter and speeding the cut. It is made for Nos. 5, 6, 8 and 10 screws. Larger sizes, ranging from ¼″ to ½″, are available on special order.

3. Level Combined in Square. You can use this tool as a square or level or as both at the same time. A slotted blade slides along rivets on the I-beam to form a square, or it can be set at a 45° angle. A wing nut adjustment locks the blade in either position.



4. Dado Blade Fits Electric-Drill Unit. This saw attachment for a ¼″ electric drill cuts grooves up to ½″ wide and 1″ deep. A setscrew adjusts blade wobble and thus controls the cut. You remove an insert in the arbor to use the blade for ordinary cutting.

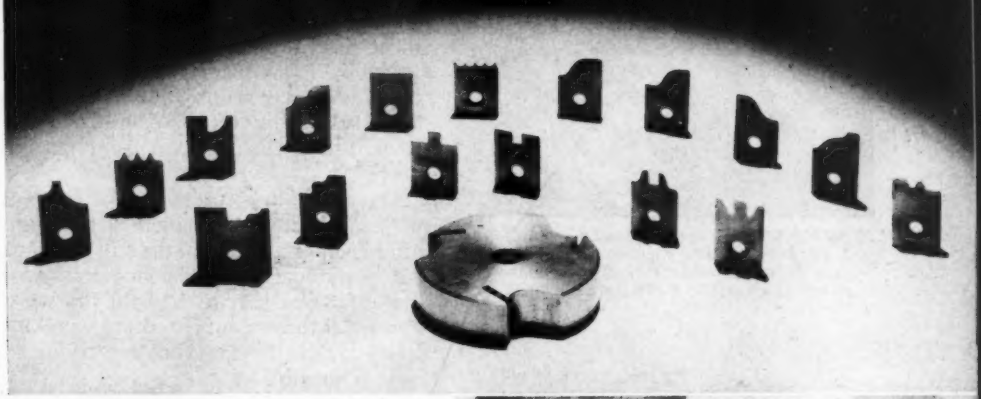


5. Hacksaw Blade Is Double-Edged. You need only turn this blade to cut either thick or thin metals. One edge with 18 teeth to the inch cuts bolts, pipe and rod; the other edge with 24 teeth, cuts tubing and conduit.

Further information about the new tools shown on this page can be obtained from: 1. Belsaw Machinery Co., 315 Westport Rd., Kansas City 11, Mo.; 2. Raymac, 15490 Dale Ave., Detroit 23; 3. Macklanburg-Duncan Co., Box 1197, Oklahoma City, Okla.; 4. Arrow Metal Products Co., 140 W. Broadway, New York City 13; 5. G. W. Griffin Co., Franklin, N. H.

You can get more from your table saw by

Learning to Use a Molding Head



CHOOSE YOUR SHAPE. All these fit into one molding head (shown in foreground), and head mounts on saw in place of regular blade. Cutters lock into three slots around rim of head.

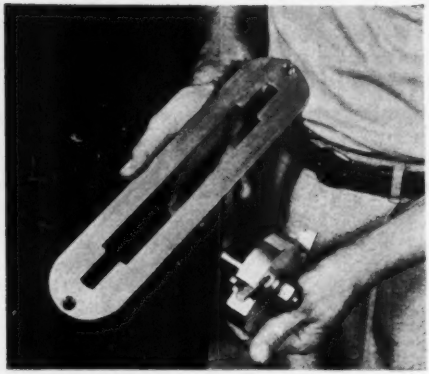
By R. J. De Cristoforo

IF YOU have a table saw, you should add a molding head. This accessory is not difficult to use. With an assortment of cutters, you can create many standard or original molding designs. You can also form edge joints, cabinet-door lips and accomplish other operations normally requiring a shaper.

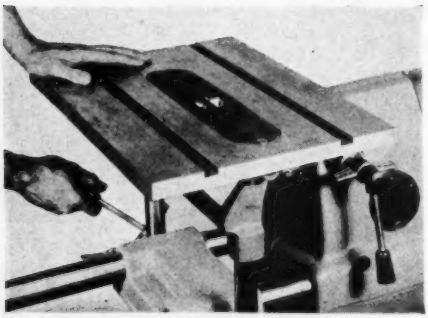
There are many kinds of molding cutters on the market, but they all work the same way on a table saw. The knives, usually sold in sets of three, are locked into slots around the edge of the head. The head is mounted on the saw's arbor between washers in the same way as a blade or dado cutter.

You can start your collection of knives with a few basic types, then add new ones as you need them. There are combination blades that permit different cuts depending on which part of the contour

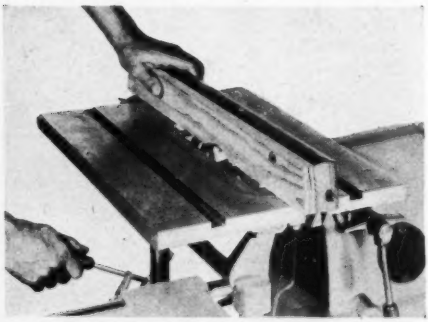
How to set up your saw to cut quick and accurate shapes



MOLDING KNIVES average about 1" wide so that you need to replace regular saw-blade insert with a dado insert like this. Always make sure that knives clear the slot before starting.



FOR EXTRA-WIDE CUTTERS, make your own inserts from thin hardboard or plywood. Screw them down, then slowly raise blades from below so that they cut their own slots to exact size.



BOLT PLYWOOD FACING to rip fence to clear the cutters, with counterbored heads on blade side and wing nuts on other. If fence has no holes, you can clamp wood strips around it

you use. With these, you can shape table edges, make your own moldings and do many other decorative jobs.

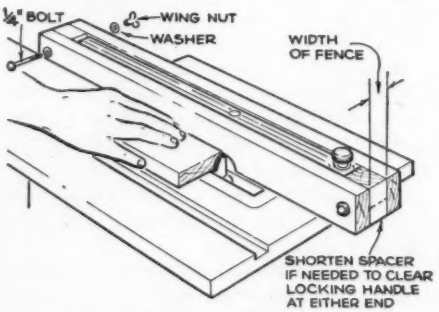
Standard cutters are each designed to do a specific job and usually require using the full contour of the blade. These cut shaped edges for window sash, glue joints, door lips and panel-door inserts. If you are uncertain which ones to choose, buy *one* set and ask for a profile sheet that illustrates the others.

Unlike a saw blade, which removes a small amount of material, a molding cutter takes a big bite. Never force the work through the blade or try to cut too deeply.

On very deep cuts, make several passes, adjusting the height of the knife after each one, to attain the full depth of cut required. If the machine stalls, vibrates, makes it hard to hold the work steady, or throws out chunks of wood instead of fine shavings, you are trying to cut too heavily.

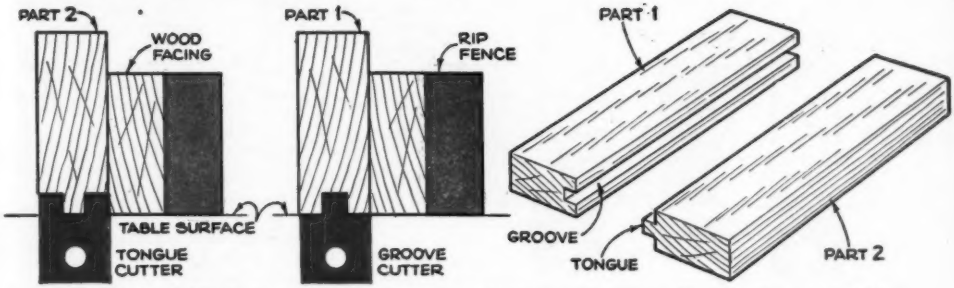
Molding heads function efficiently at the same speed required by a regular saw blade. Slowing them up or increasing their speed in any way may be dangerous. Be sure to read the manufacturer's literature provided with your molding head for any special instructions.

Right after use, clean the knives of gum and dirt and coat them with oil to prevent rust. Store them so that the cutting edges will be protected from nicks. The head itself should also be cleaned, especially the slots in which the knives



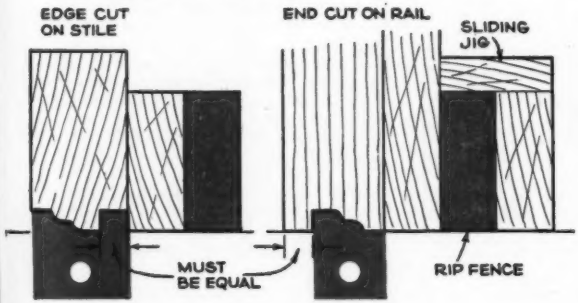
(sketch at right above). To cut the semicircular recess, slowly lower wood facing over a head fitted with straight-edge cutters. Be sure that knives clear rip fence.

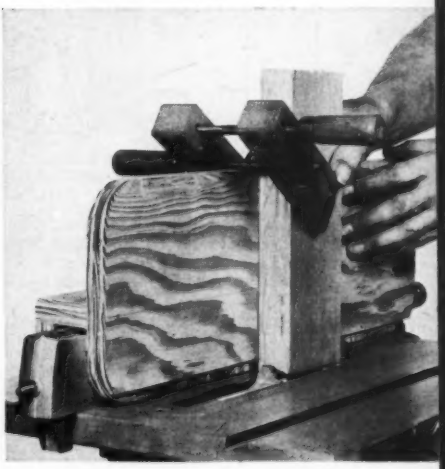
Using tongue-and-groove cutters



LOCK WOOD FENCE flush with edge of cutter and run first pieces through. To set up mating cutter, make tests on scrap to be sure that tongues and grooves line up. On wood thicker than width of blade, center stock for first pass, then rip off shoulders left on tongue.

Using a sash cutter

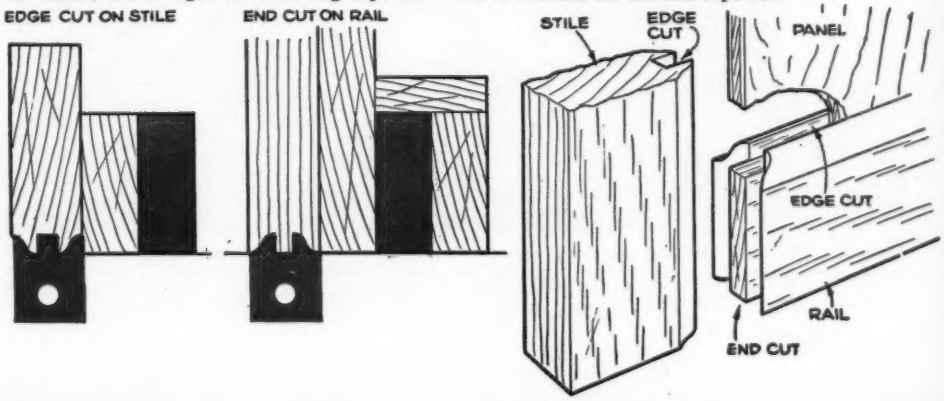




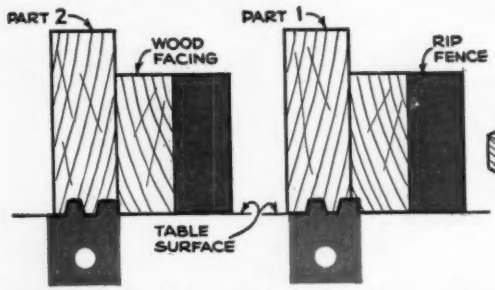
SASH CUTTER rabbets one side to take glass and puts a decorative edge on the other. To join pieces, cope cut is made in ends of cross rails with reverse-contour blade to mate with vertical stile. Jig at right slides over rip fence for making successive passes on rail-end cuts.

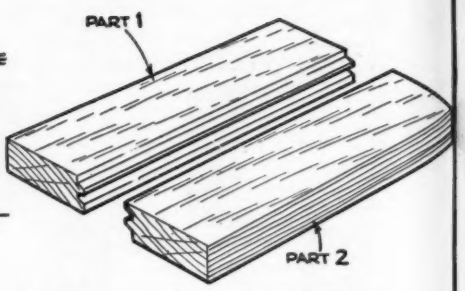
Using panel-insert cutters

INSERTING PANELS in cabinet doors is easy with these mating blades. One at left makes groove for insert, one at right the matching cope cut on the end of the rail. Note how pieces meet at corners, forming a miter-like joint. Use jig above to make the rail-end cope cut.



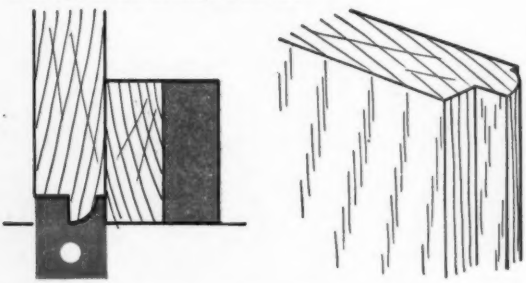
Using a glue-joint cutter





SINGLE CUTTER makes matching grooves for edge-gluing boards. On stock of same width as cutter (usually 1"), both mating pieces can be run through on the same setup, then one of them flopped over to fit together. On thinner stock, make first cut by lining up board with *inner* edge of blade. Then cut mating piece by lining it up with the *outer* edge of blade.

Using a door-lip cutter

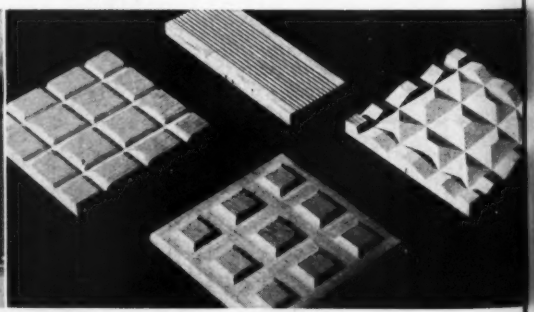


MOST DOOR-LIP CUTTERS are designed to leave a slight shoulder on the face of the door. If you don't care for this, shift the rip fence so that the shoulder-cutting portion of the blade is hidden under the wood facing. Curve of lip will then come flush with face of door. On stock thicker than blade, cut the lip as usual, then rip off remaining stock to complete the rabbet. If you rabbet the door all around, make the cross-grain cuts first so that any splintering at the corners will be cleaned off by the rip cuts.

fit. Never leave knives locked in the molding head.

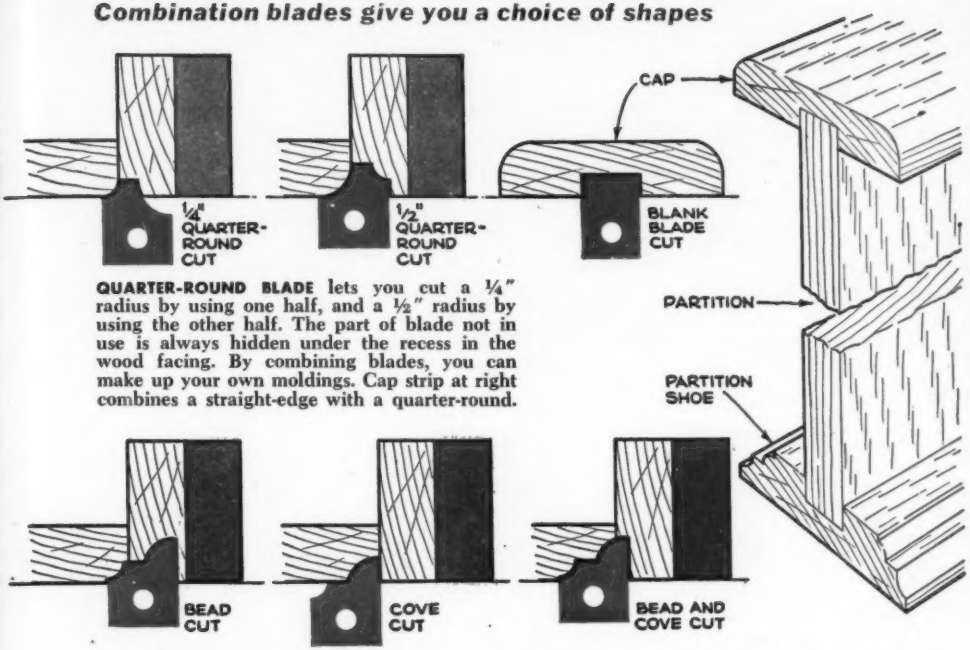
Remember, no matter how good your equipment is, cuts won't be good unless the setups that you make are accurate. So spend a few extra seconds to check such things as knife height and rip-fence settings. Make trial cuts in scrap wood *before* cutting actual parts. This is especially important when you're using matching pairs of cutters, such as for window sash, panel inserts or tongue-and-

These tricks help you make special shapes



BY TILTING SAW TABLE, or arbor, you can make pyramid patterns and raised-panel designs like the one at far right in right-hand photo. Other designs at right are made with criss-cross and parallel cuts on a flat table. Combination pusher and hold-down block (at left) has cleat at rear edge that hooks over work so that you can keep your fingers clear of the blades.

Combination blades give you a choice of shapes

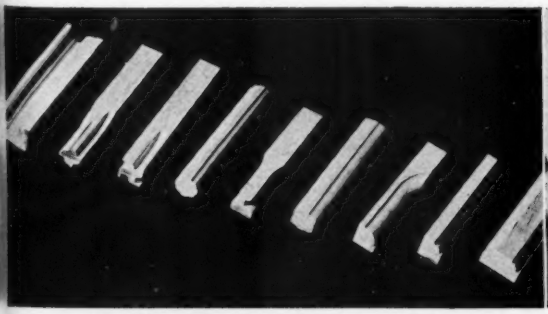


QUARTER-ROUND BLADE lets you cut a ¼" radius by using one half, and a ½" radius by using the other half. The part of blade not in use is always hidden under the recess in the wood facing. By combining blades, you can make up your own moldings. Cap strip at right combines a straight-edge with a quarter-round.

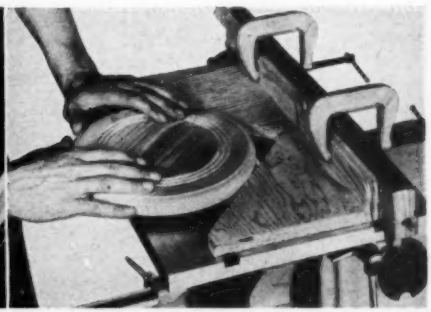
BEAD-AND-COVE BLADE cuts a convex shape when you conceal the tall half under the fence facing, as at left above. At center, you get a concave cut by shifting the fence out of the way and lowering the blade to use upper cutting half. In middle position at right, full blade is used to give a decorative edge, such as for a table or the partition shoe shown here.

groove joints. The mating cutters must line up perfectly or the joints will be spoiled. If the fit is tricky and you're in doubt, it's best to make the cuts on slightly thicker stock, join them, then trim off the excess wood.

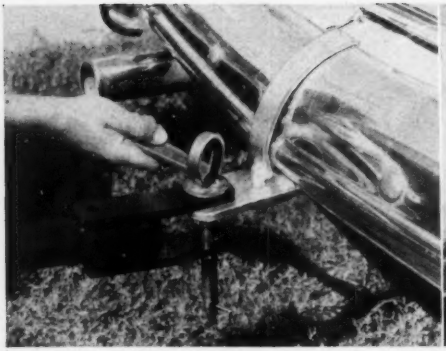
It's also an excellent idea to cut the full profile shape of each knife as soon as you buy it and to "file" it for reference. Then you can easily tell, without practice cuts, what knife, or what part of the knife, you need. END



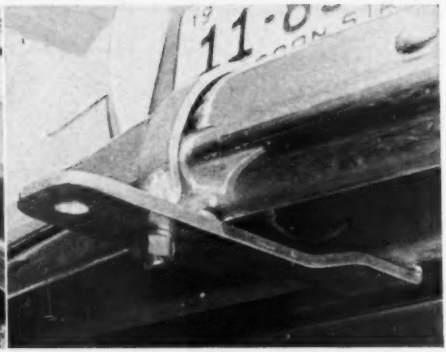
TO SHOW WHAT YOU CAN DO, all of the shapes above were made with a single cutter, the combination ¼"-and-½" quarter-round. Trial cuts on scrap will help you get shapes that you want.



SHAPE CIRCULAR PIECES by clamping two 45° triangular blocks to fence to form V. Feed work into V until it rests firmly, then turn disk slowly against the rotation of the blades.



A CLEVIS PIN, locked on by a cotter pin, holds the trailer tongue to the hitch. A safety chain hooked from the car to the trailer is advisable.



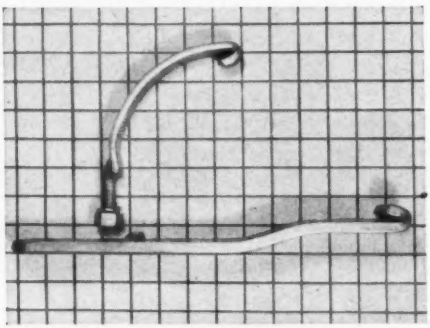
LOWER MEMBER of the hitch hooks to the rear cross channel of frame, upper one to bumper. Turning up the nut shown attaches the hitch.

On-Off Trailer Hitch Clamps in Place

Do you need a trailer hitch on your car just once in a while? Do you dislike having a permanent fixture hanging on the rear bumper?

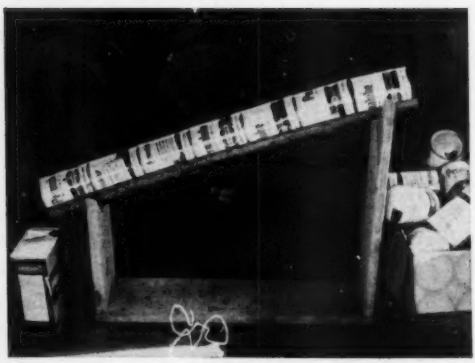
Here, then, is the hitch for you. It goes on or off the car in less than a minute. Even so, you need not shy at heavy loads since it pulls from the frame of the car—not just from the bumper.

The bottom member was formed from a 15″ piece of ⅜″-by-2½″ mild steel, the supporting strap from an 8¾″ piece of ¼″-by-1½″ mild steel. A bolt with its head removed was welded to the lower end of the latter member. A small steel rib was also welded to the top surface of the bottom member. When the hitch is in place, the rib rests against the outer edge of the bumper and keeps the hitch from sliding forward on a sudden stop.—*Ken Hadenfeldt, Storm Lake, Iowa.*



A BACKGROUND OF 1″ SQUARES shows the dimensions of the parts, made to suit a 1954 Ford.

This Draining Rig Gets All of the Oil from Those "Empty" Cans

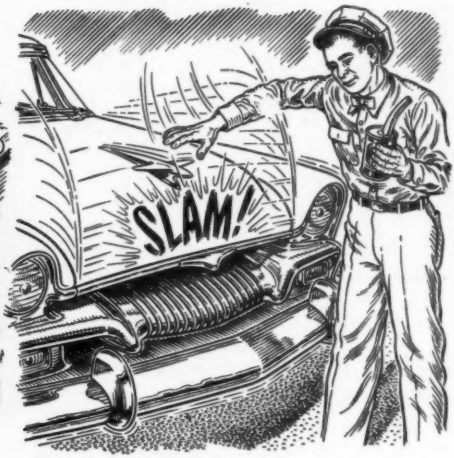


A SMALL amount of motor oil always remains in the tin containers after make-up oil has been added at a service station. In time, these drops can add up to a gallon of oil.

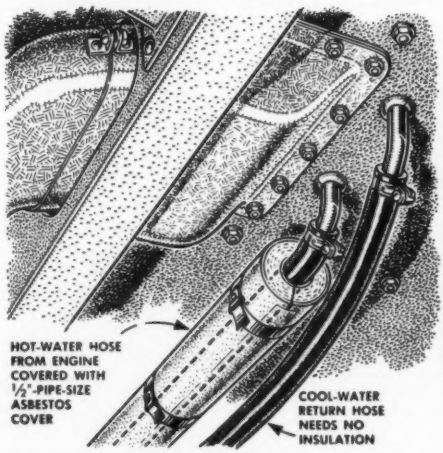
And it doesn't take long, either, as John Schmidt of Townsend, Mont., has discovered. He saves the drops with this simple rig. A length of eaves trough was set at a slant in notches in upright boards. When an empty is placed at the bottom of the line, the upper can is shoved off the rack and drops into a box for disposal. Oil drains into a gallon can at the lower end of the trough.

Hints FROM THE MODEL GARAGE

Carrying long pieces of pipe in a pickup truck is easy when you do it this way. Install empty pails in the rear corners of the truck bed to serve as quivers for the ends of the pipe lengths. Be careful if you should come to an underpass that's a bit low.



There ought to be a law against service-station attendants who slam a hood shut. Engineers say that hoods were designed to close with gentle pressure. If slamming is required, previous slamming may have damaged the latch or warped the hood itself.

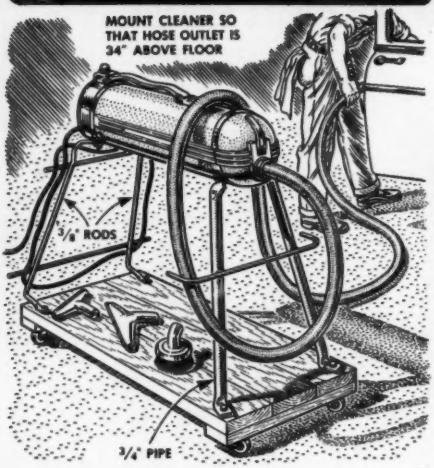


An underseat heater may lose heat from a long supply line. If you have this type of heater, better check to see whether you can do something about insulating the line. Applying the snap-on type of insulation used in houses will do the trick very effectively.

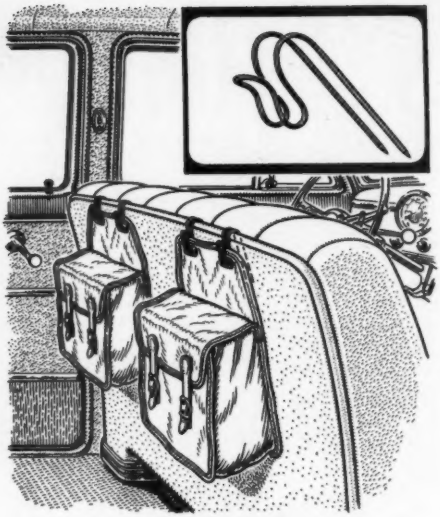
Two-tone parts boxes are not yet a necessity in a service garage. But one operator says that frequent replacement of gritty old boxes with new, clean ones pays off. Soft rubber on the bottoms protects fenders. Parts are cleaned before they're put back.

Please turn the page for more auto hints

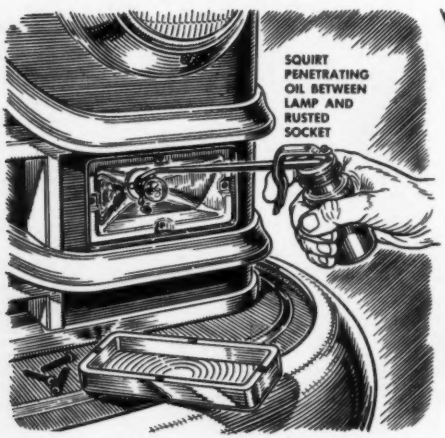
MORE Hints from the Model Garage



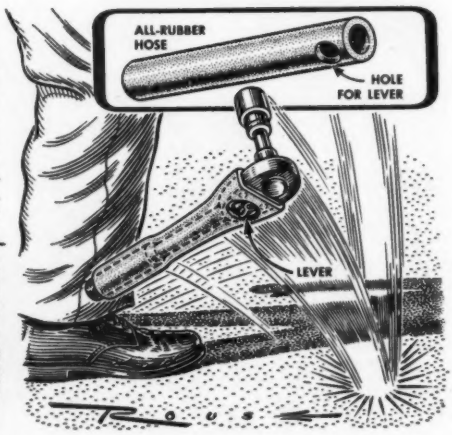
A vacuum cleaner mounted on a rolling stand like this makes it easier to clean car interiors in a service station. Dragging on the floor is eliminated and the cleaner is kept out of grease and dirt. A more effective hose length is achieved since the cleaner is at cushion height and follows easily as the cleaning job progresses.



A pair of bicycle saddlebags mounted like this will add a lot of useful storage space to a sedan. The bags look good, too. Form a pair of supporting pins for each bag from 1/16" piano wire and sharpen the points. Just push the pins down into the upholstery. The bags can be lifted off the hooks and used as carriers if desired.



Squirt penetrating oil around a tail-light or parking-light bulb that you find rusted fast to its socket shell. Otherwise, you run the chance of damaging the socket. Coat the socket and the new bulb with oil so that removal next time will be fast and easy.

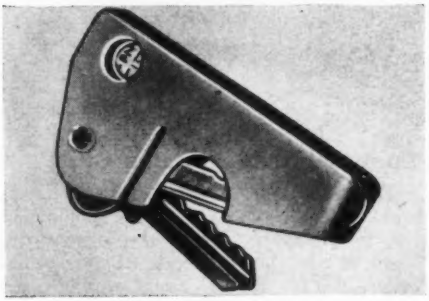


Dropping a ratchet onto a cement floor, when the tool is being used with a socket set under a car, is a common occurrence. Often the small lever is snapped off. As a safeguard, one mechanic slipped a piece of rubber hose over the wrench, like this.

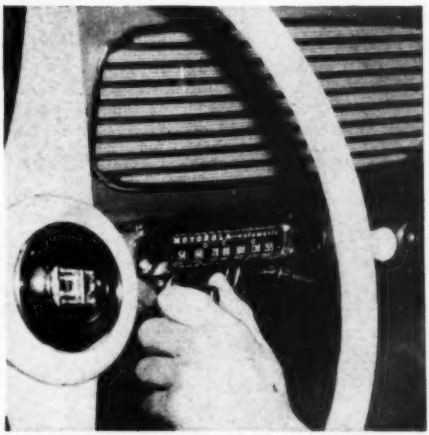
New for Your Car

1. Trunk Lamp Reels Out. This mercury-switch lamp is a trunk light (top left) that can be reeled out as a trouble light (bottom) for fixing tires or making other roadside repairs. The accessory, designed for 1956 Pontiacs, has a 17′ extension cord. It lights only when placed in a horizontal position.

Further information on these new car products can be obtained from: 1. General Motors Corp., Detroit, Mich.; 2. Gift Horizons, 475 Fifth Ave., New York City 17; 3. Motorola, Inc., 4545 W. Augusta Blvd., Chicago 51, Ill.; 4. The Ettinger Mfg. Co., 1319 S. Michigan Ave., Chicago 5, Ill.



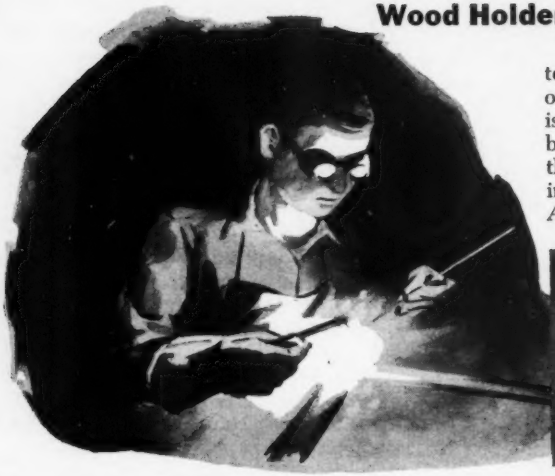
2. Air Gauge Set in Key Case. This case will hold your car keys and also check the air in your tires. It has a molded-in air gauge that registers pressure in a small window. The case holds three keys.



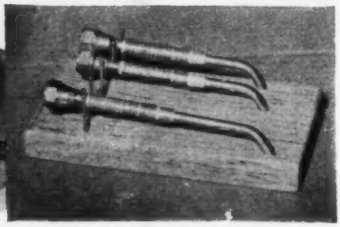
3. New Radio Fits Volkswagen Dash. A six-tube radio with a separate 6″-by-9″ speaker is being manufactured in this country for installation in Volkswagens and some other foreign cars. The faceplate is designed to match the VW's interior decor.

4. Crash Pillow Sticks on Dashboard. A safety pillow helps to protect a front-seat passenger who may be thrown against the dashboard in an accident or sudden stop. Suction-cup buttons hold it in place.

Wood Holder Guards Welding Tips

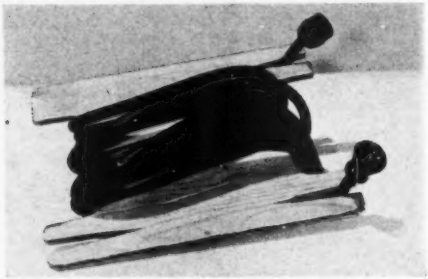


WELDING-TORCH tips will be protected in a holder made of a block of hardwood. Drive a line of finishing nails near one end of the block; then measure off holes for the tip orifices and drill the holes into the wood at an angle.—*M. C. Anderson, San Lorenzo, Calif.*



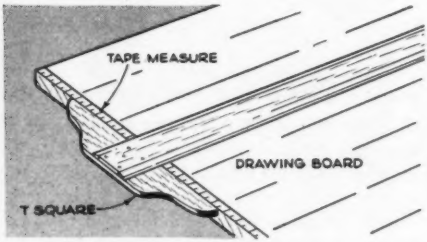
Newspaper Keeps Lathe Clean

BEFORE you start a lathe job, slip newspaper under the bed to catch dust and shavings. When the job is finished, brush off the ways and pull the paper out from under the bed.—*Harrison Neustadt, NYC.*



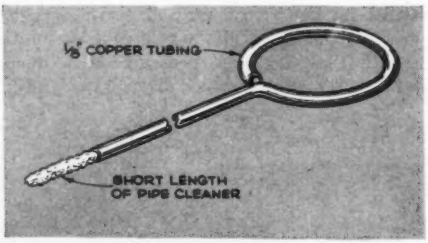
Spool Holds Extension Cord

YOU won't knot an extension cord if you wind it on an H-shaped plywood spool when you put it away. Notch the legs of the spool to take the cord ends wherever they come.—*W. G. Tilsher, San Gabriel, Calif.*



Tape Measures Off Ruled Lines

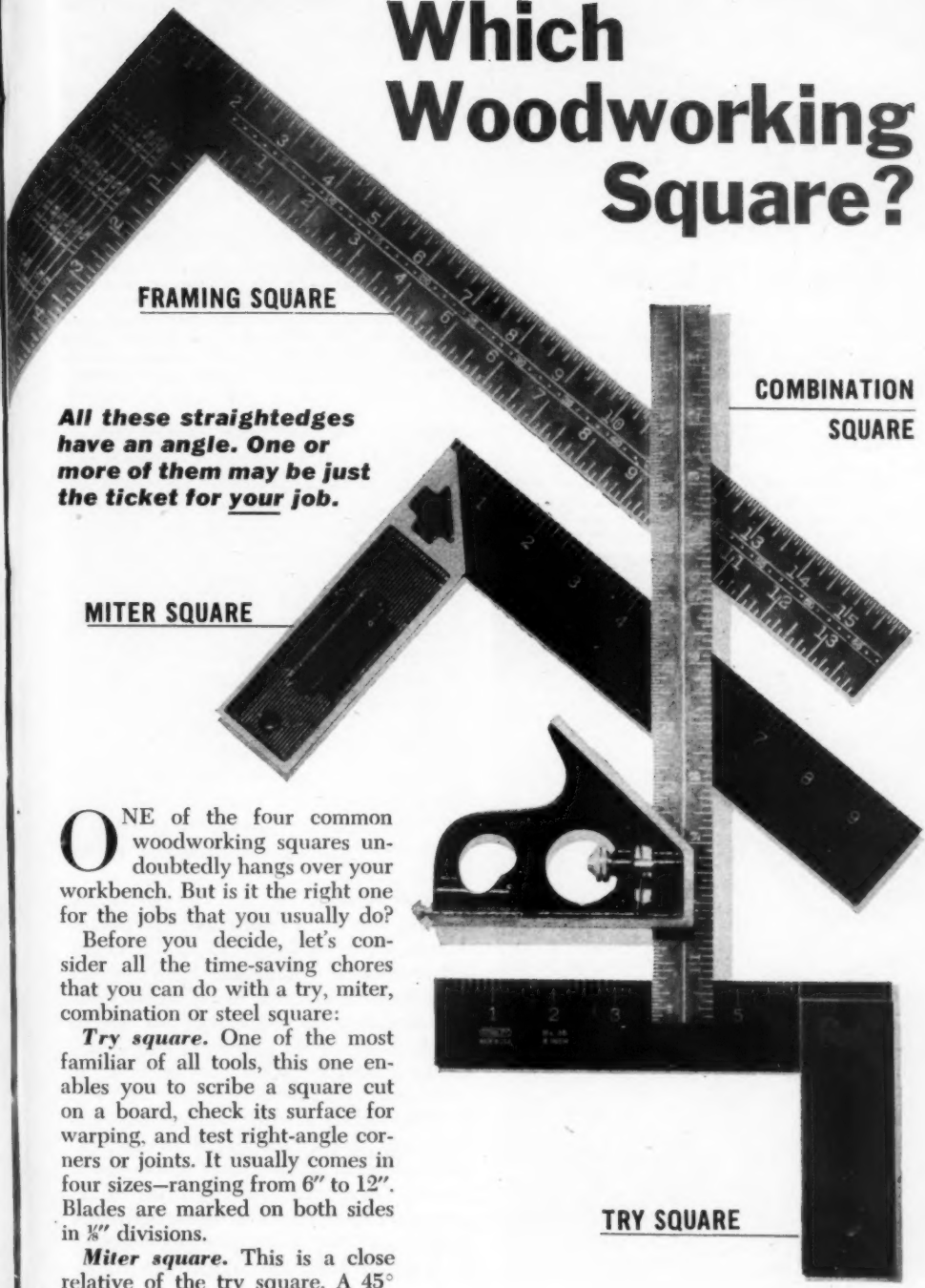
A CLOTH measuring tape tacked to one edge of a drawing board will be helpful when you lay out horizontal ruled lines. Use it with an intersecting T square for spacing.—*David E. Holt, Columbus, Ohio.*



Pipe Cleaner Makes Flux Brush

A SHORT length of pipe cleaner inserted in ⅛" copper tubing is a handy, disposable brush for applying acid flux to soldering work. Bend the tubing at one end to provide a loop for hanging it up.

Which Woodworking Square?



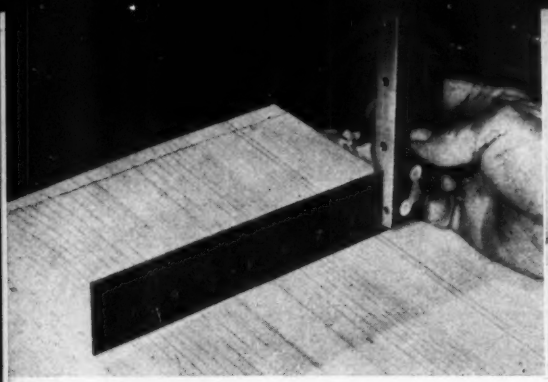
All these straightedges have an angle. One or more of them may be just the ticket for your job.

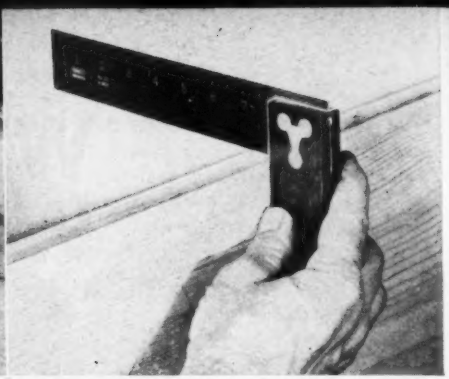
ONE of the four common woodworking squares undoubtedly hangs over your workbench. But is it the right one for the jobs that you usually do?

Before you decide, let's consider all the time-saving chores that you can do with a try, miter, combination or steel square:

Try square. One of the most familiar of all tools, this one enables you to scribe a square cut on a board, check its surface for warping, and test right-angle corners or joints. It usually comes in four sizes—ranging from 6″ to 12″. Blades are marked on both sides in ⅛″ divisions.

Miter square. This is a close relative of the try square. A 45°





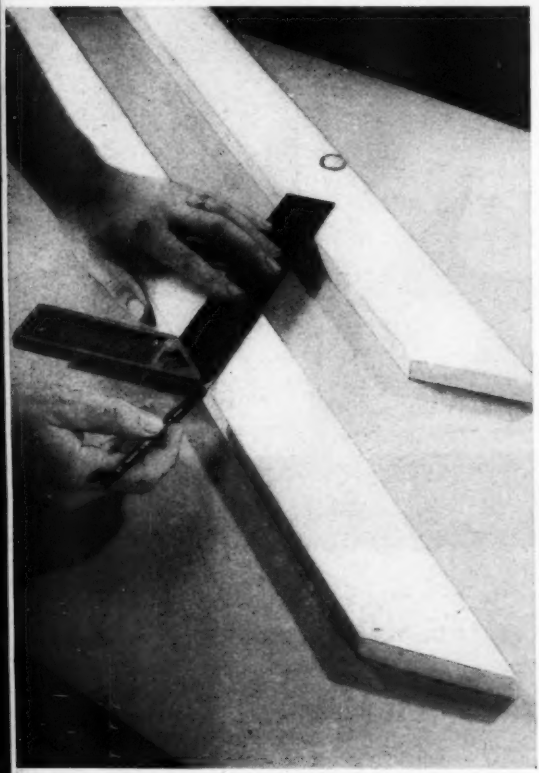
TESTING CORNERS, like marking and checking right-angle cuts, is a job that can be done with any square. The try square does little more, but is easy to use, compact, and low priced. You can check the squareness of board edges (above), or press the handle against an edge and test a right-angle cut at the end of a board.

Using the Try Square

USED AS A STRAIGHTEDGE, a square detects warping. Press edge of blade firmly against the surface. A sliver of light showing between blade and board indicates a curve in the wood.

Using the Miter Square

45° SLOPE on the handle of a miter square adds mitering to the tricks that you can do with a try square. The combination square has a similar slope on the handle for marking miter cuts.



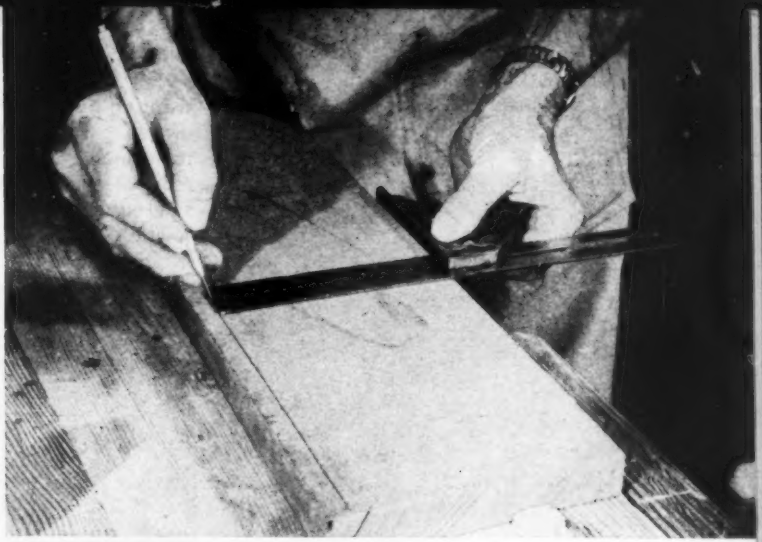
slope on the blade end of the handle, instead of a right angle, is the only difference. You can slide it along the edge of a board and mark off miter cuts, or check those already made. Like any straightedge, the miter square will detect warping. Sizes and markings are like those of the try square.

Combination square. This jack-of-all-jobs will square and miter or will double as a marking gauge, depth gauge, level, plumb or straightedge. Blades usually come 9″ or 12″ long, with their edges divided into $\frac{1}{8}$″, $\frac{1}{16}$″, or $\frac{1}{32}$″ intervals. The more expensive machinist's jobs come in a 4″ to 24″ range and are made to more exacting standards for metalworking. You can use them for woodworking, too.

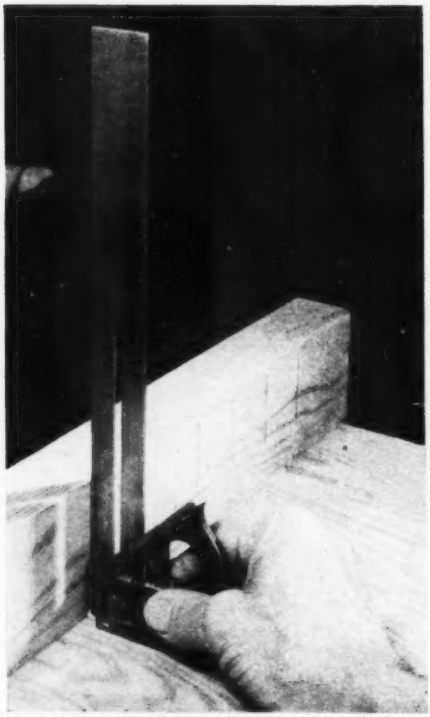
Steel square. This is a big one—made for big jobs. A 24″ body and 16″ tongue handle layout and checking on the heaviest lumber. If you tackle a garage roof or a house gable, the rafter version will do most of your arithmetic, too. Tables on the face simplify marking length and angles of cut for each kind of rafter in a variety of roof styles.

Other tables on this square help you work out board feet measurements, lay out eight-sided figures, and size common braces. There are simpler versions, called carpenter's squares, that omit the rafter tables—and cost less. You can get almost any combination of tables you might

Using the Combination Square

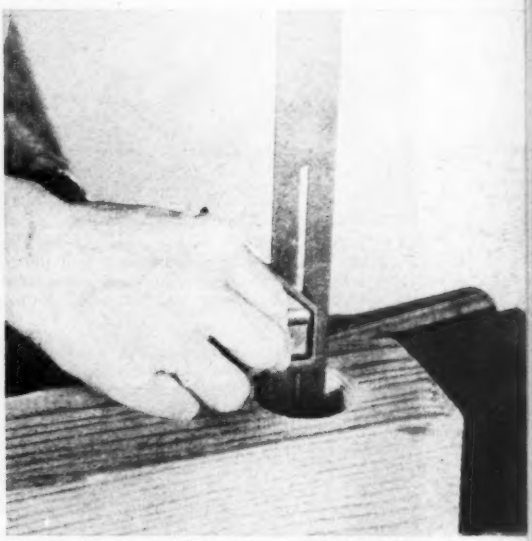


AS A MARKING GAUGE, a combination square will easily mark even long boards to width. Set the adjustable handle, then hold a pencil against the blade end as you slide the square along the edge of the board.



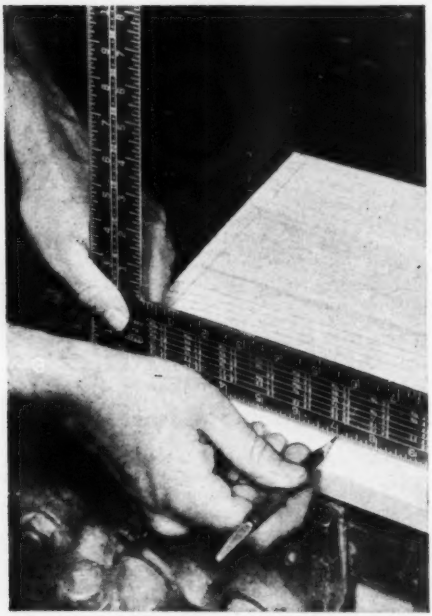
CHECK RIGHT-ANGLE JOINTS with a combination square by setting the handle at one end of the blade. Light showing between blade and board indicates that this joint is out of square.

MARKING PLUMB LINES on a wall, plumbing studs and leveling an auger bit for horizontal drilling are jobs for a combination square. A level in the handle makes them possible.



GAUGE HOLE DEPTH by resting the blade end on the bottom and sliding the handle down until flush with top of hole. You can then read its depth directly from the blade markings.

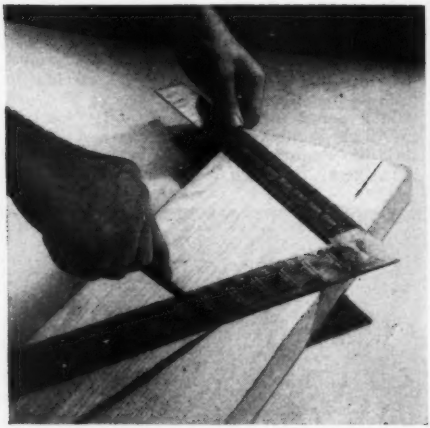
Using the Framing Square



LAY OUT BIG BOARDS with a steel square. For accuracy, hold the square on edge and pencil right next to the markings. Start measuring from the 1" mark, as corner may be worn round.

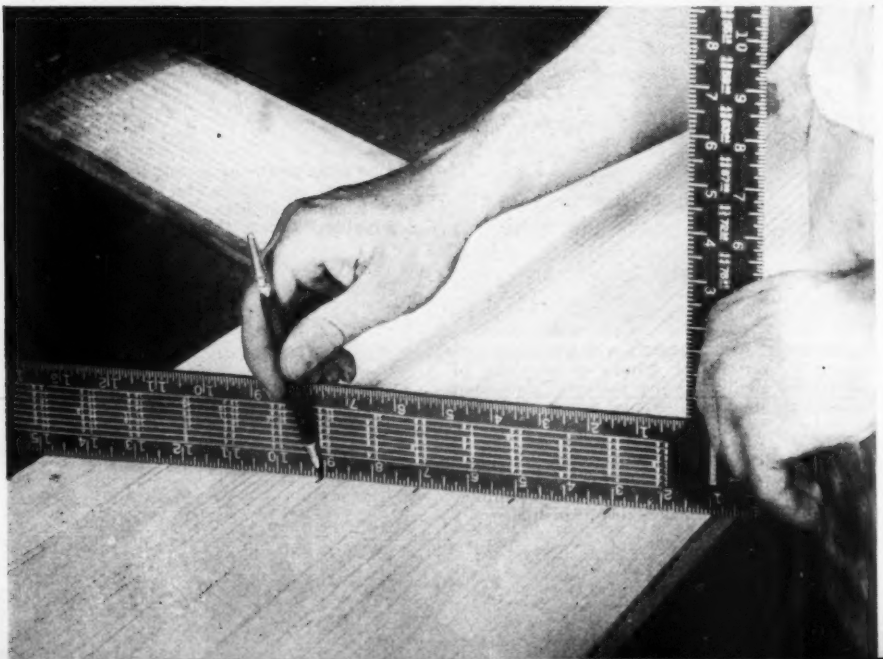
want on a steel square. Adding a square or two to your tool collection is not a big investment. All but the large steel squares cost less than $5. The fanciest steel square costs less than $10.

The cost of wood spoiled on a single fair-sized job can top the cost of any good square. Having the right one *could* save you money.—*Edwin M. Love.*



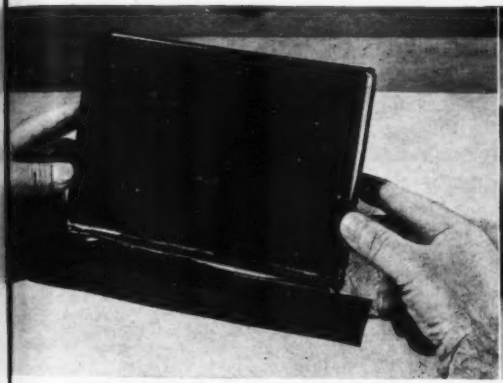
ROOF RAFTERS are laid out with a rafter square and very little arithmetic. Tables give length of common, hip and valley, and jack rafters. Square also marks the proper end cuts.

DIVIDE A BOARD into equal strips by inclining a square, or straightedge, at an angle to include as many equal divisions between the edges as you want. Then mark and gauge them. END



4 Steps in Renewing a Book Cover

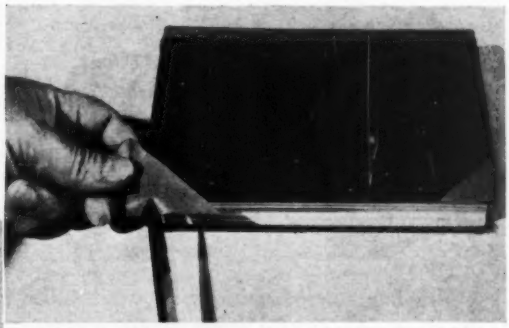
THE more useful a book is, the faster it shows symptoms of old age: torn back, bent corners, scuffed edges. To give an old favorite new life, buy a roll of cloth adhesive tape at a stationery store. Choose a width that will cover the back of the book and extend at least ½" onto each cover. Use it as below.



1 CENTER THE BACK of the book on a strip of tape that overlaps it ¾" at each end. Roll it on lightly to simplify later steps. Trim frayed threads off first to make a neater job.

2 MAKE TWO CUTS in the end pieces. Press one outside strip in place. Then fold the center strip inside the back, on itself. Finally, press the other outside strip onto the cover.

3 CREASE HINGES like this. Smooth edges of tape with your thumb where creasing pulls it loose. Smooth the back on firmly now, too.



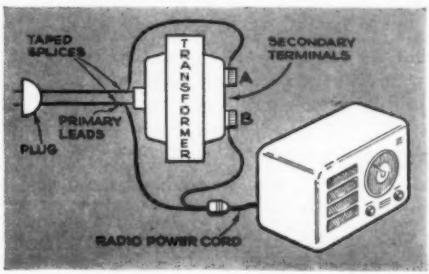
4 CUT CORNER GUARDS by halving squares of tape. Press on a triangle to overlap a corner by ½". Make two cuts, each in line with an edge of the book cover and to within ⅛" of it. Fold center flap first.

How to Boost Radio Reception

WHERE line voltage is low, you may be able to improve radio reception with a filament or doorbell transformer.

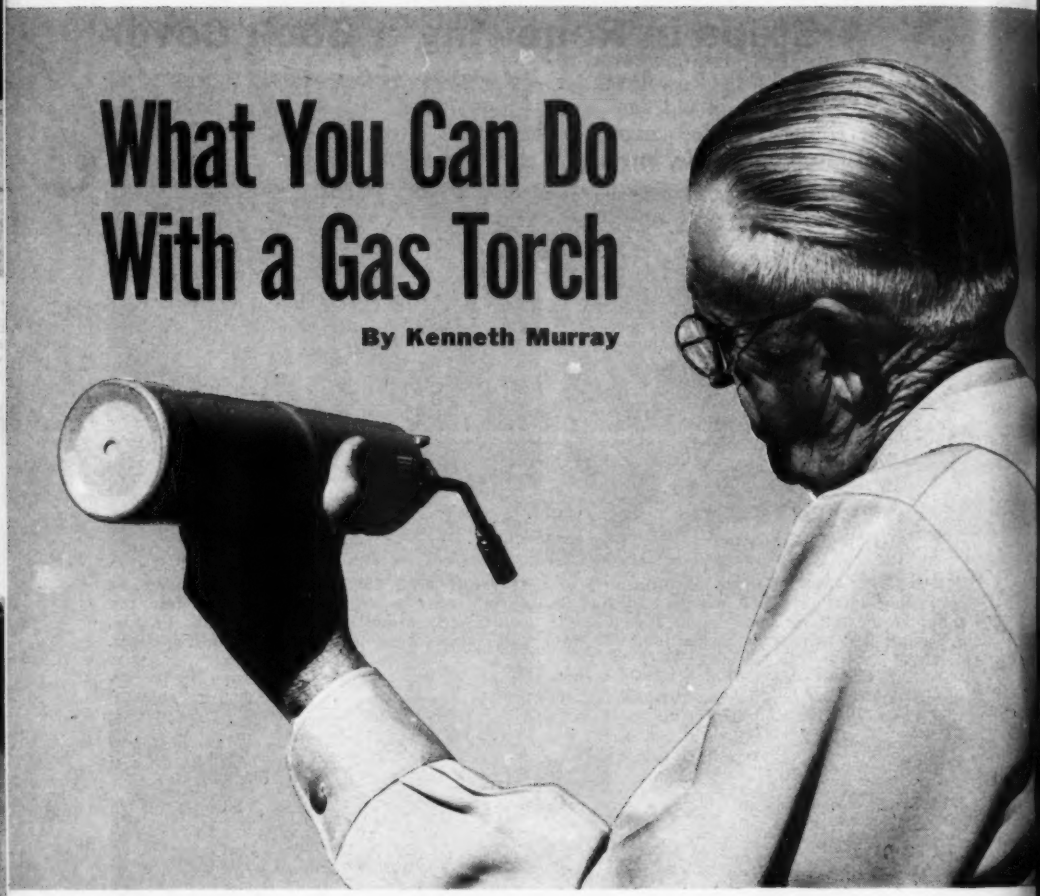
Connect the transformer in the line as shown in the diagram at the right. Then try it. If voltage is decreased instead of being boosted, reverse the connections *A* and *B*.

Do not use this circuit for hi-fi outfits, TV sets or other appliances which draw more than the rated transformer wattage.



What You Can Do With a Gas Torch

By Kenneth Murray



ABOUT the only problem when you use a gas torch is figuring out what it *can't* do. These small, inexpensive propane burners will handle a range of chores extending from heavy soldering to some of the oddest odd jobs that you'll ever find around your home.

The torches are self-contained and self-pressurized, so there's no pumping or priming to fuss with. They are available at hardware stores for about $5 to $7. To fire one up, you turn a knob and light a match. When one tank is empty, you throw it away and hook on a refill that costs about $2.

Two standard burner tips give you a broad flame for general heating or a slim pencil point for fine work. You can also buy accessory tips or make up your own to do many special jobs.

By regulating the torch's fuel flow, you can adjust the flame temperature from a mild "stand-by" heat to a torrid 2,300 degrees. It will take on easily such high-temperature jobs as brazing and silver soldering.

Handy on picnics. A torch is safe to carry along with you in your car, if you are careful to keep the fuel valve tightly closed. It will quickly start picnic fires when the wood is wet, cook food, and help you to make roadside repairs.

If your blacktop driveway kicks up a hole, just heat the dislodged material

Special burner tips that you can make

CUTTER BLADE slices easily through plastic and asphalt tile. File down a short length of ⅜" brass or copper tubing to a push fit in the soldering-tip holder. Flatten tip in a vise and file to a knife edge.

SPREADER TIP is made of tubing in same way as knife blade at left. Bend a small flat portion on the end and you can "iron" together cracks in toys and utensils that are made of heat-softened thermoplastic.

FOR VERY FINE SOLDERING, as in repairing delicate jewelry, try an oil-can spout fitted into an ordinary burner. To remove the spout from the screw ring, heat until solder runs, then push the spout out free.

These are special tips that you can buy

SOLDERING TIP speeds work on large metal areas, like this dustpan, that tend to diffuse heat from ordinary irons so that the solder doesn't flow evenly. Soldering this thin strip on the pan's edge to make it sweep up dirt better is easily done by adjusting the torch's fuel flow so that it gives intense heat.

FLAME SPREADER heats broad areas, like the backs of these asphalt tiles. Soften tiles slightly before installation and they will lie flatter. To remove a worn or broken one, warm the face to loosen the adhesive and you can then pry it out easily. If the tile has lifted or buckled, heat the surface and press it back in place.

A gas torch does many chores around the home

OLD GLAZING PUTTY peels off neatly with blade if you soften it first. Keep the pencil flame aimed directly at the bead, away from the glass and wood, and move it along steadily. The clean, dry surface that's left is easy to put fresh putty on.

HEAT CALKING GUN until it's warm to the touch, and the compound will flow more easily, especially outdoors in cold weather. The soft calking will penetrate fine cracks better, then stiffen up quickly as soon as it cools on the work.

DENTS IN FURNITURE can be removed with the homemade spreader, a flattened ⅜" tube inserted in the soldering holder. Iron a moist piece of cotton flannel over the dent until it sizzles. The steam will swell the wood fibers back to normal.

Use it for these unusual jobs in your shop

SMALL PARTS to be brazed or silver-soldered can be held between two angle plates in a C clamp. To mend a bandsaw blade, bevel ends, insert piece of silver solder between, and heat them. When solder flows, clamp with preheated pliers.

STICK ADHESIVE used to fasten sanding disks to a wheel will flow on smoothly without lumps if you first warm the metal plate with the torch's flame spreader. Use it also to heat worn disks so that you will be able to peel them off easily.

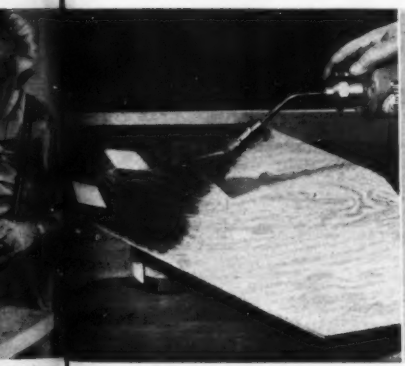
YOU CAN BEND thin pieces of wood this way without a costly steam chamber. Wrap the wood strips with soaking-wet cloth and play the flame on the cloth to produce steam. Slowly bend to the desired shape, and then clamp the pieces in place.

For your car, too

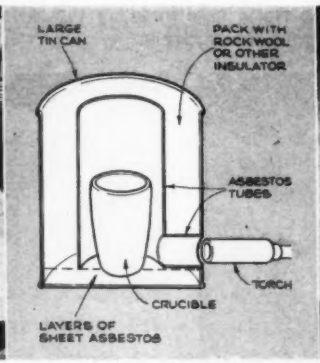
YOU CAN CLEAN SPARK PLUGS quickly by burning off the carbon deposits first. Use the concentrated pencil-flame burner aimed at the electrodes. When the parts turn a grayish color, scrub off the ash with a wire brush. Keep the flame away from porcelain parts, which may crack under the heat.

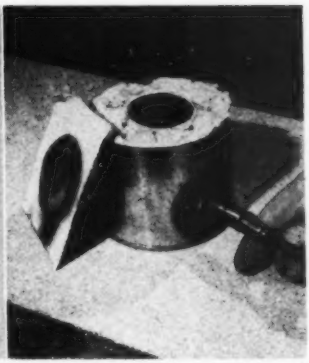
YOU CAN BAKE OUTDOORS at home or on camping trips with this $3 portable oven and torch setup. Block the oven up on bricks or stones and prop the torch with wire or rocks so that it can't roll. For the best heat, use the flame-spreader accessory and direct it at the deflector plate on the bottom of the oven. Put a piece of asbestos sheet over the table.

WHEN HOUSE LIGHTS GO OUT, or on a camping trip, try this for emergency illumination. Tie a 12-cent Coleman Grade A mantle over the pencil-flame burner and burn it off with a match before lighting the torch. It will give you about 200 foot-candles of light—enough for a small room. Be sure to place it out of children's reach and where it can't tip over.



CHARRING WOOD for a novel decorative finish is done quickly and evenly with the flame-spreader attachment. To leave unburned designs, paste on templates cut from asbestos sheet. Use clear varnish or lacquer for a high-luster finish.





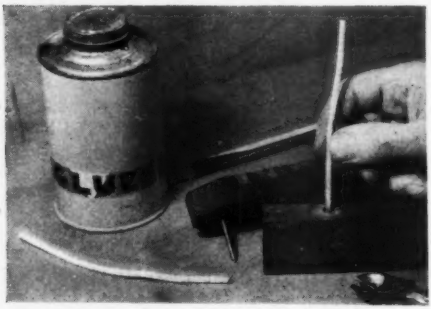
TIN-CAN FURNACE lets you melt and alloy small quantities of brass, bronze, copper, aluminum and other metals without expensive equipment. Use a wide, squat can, like those that coffee or shortening come in, and line the bottom with several layers of asbestos sheet, as shown in the sketch. Run a short asbestos tube through the side of the can, just large enough to let you slip in the torch's burner. Adjust the tip so that it just enters the larger-diameter tube set vertically inside the can.

and tamp it back in. If you need to split stone, heat a line around the break point, whack it with a sledge hammer, and the pieces will part neatly.

Safety rules. The main thing to remember is that you are working with fire—and hot fire at that. Never put a burning torch where it can be touched, tipped or tripped over by children or others. And never leave a burning torch—shut it off and place the still-hot burner where it can't be reached until you return. If you prop it up, make sure that it can't slip. If you work close to wood or other flammable materials, slip a sheet of asbestos in between for protection. END

Stepladder Helps Drill Long Piece

A STEPLADDER will support the end of long work in the drill press. Using a level on the work, raise or lower the drill press table until it is even with the ladder step.

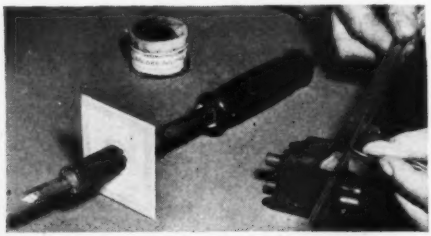


Pipe Cleaner Anchors Screw

RESET a wood screw by plugging the oversize hole with a glue-coated pipe cleaner. Insert the cleaner and clip it flush with the hole. If necessary, use more than one.

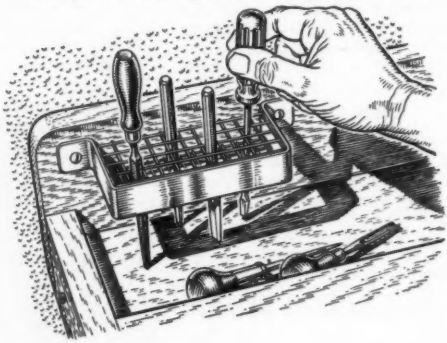
Hardware Cloth Holds Tools

SMALL tools can be kept handy in a rack like this on the backboard of a workbench. Bend the frame from an inch-wide strip of 18-gauge sheet metal. Cut two pieces of ⅜"- or ½"-mesh hardware cloth. Solder one to the top edge and one to the bottom of the frame, making sure that the meshes match.

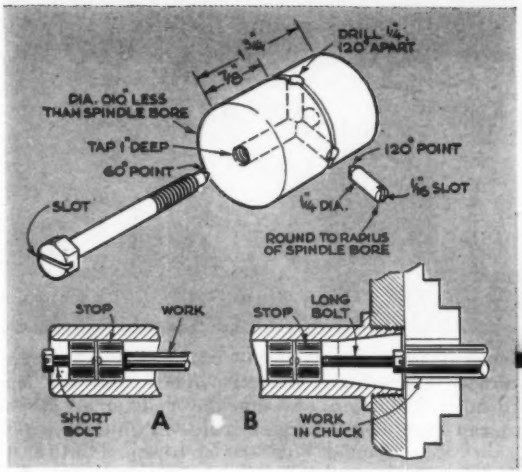


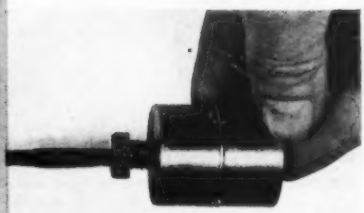
Soldering Iron Carries Rest

A SQUARE of asbestos cemented on the shank of a soldering iron will let you rest the hot iron on any surface. Tape or shellac the edges of the square to keep them stiff.



NEW Shop Ideas





Stop Locates Lathe Work. This spindle stop will locate successive workpieces all exactly alike in the lathe. It can be locked at either the nose or the outboard end in a matter of seconds.

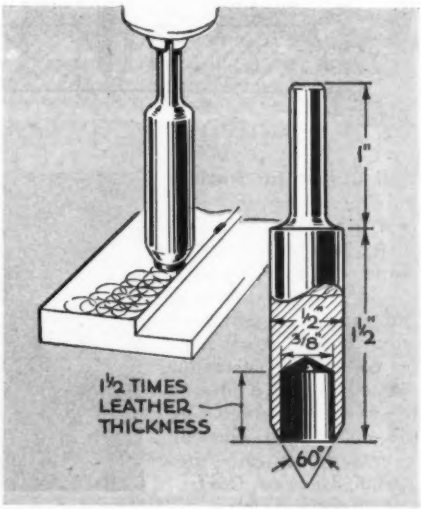
Turn and groove a 1¾" length of bar stock as in the drawing. Tap a ¼" or ⅜" hole drilled 1" deep from one end. Use the chuck jaws to scribe three lines 120° apart across the turned groove.

Drill three ¼" radial holes at these locations through to the tapped hole. From ¼" drill rod, make three pins as in the drawing. Bend a ring of piano wire into a circle to fit tightly into the groove and the pin slots. Snap it on to retain the pins when the stop is not in the lathe spindle.

On the threaded end of a cap screw that fits the tapped hole, turn or grind a 60° point. Slot the head to fit a big screwdriver. Tightening the bolt will force the pins out against the spindle wall. Use a short bolt for locking the stop in the outer end to suit long work as at *A*. For short work, use a bolt long enough to permit seating the stop where the spindle bore becomes parallel back of the taper, as at *B* in the drawing.—*Phil McCafferty, Stanwood, Iowa.*

Tool for Engine Finish. This spotting tool cuts its own leather pads from old machine belts or shoe-repair scraps. Turn it from drill rod, bore the big end, and turn the 60° angle to form a sharp edge.

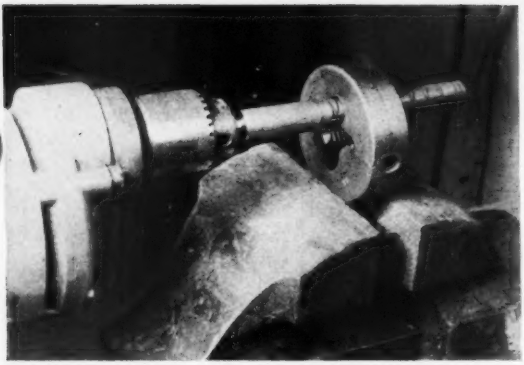
Place the leather on a wooden surface. Using the tool as a punch, cut out a leather disk. Pick it out and cut another. Leaving this in, push the first one back; it will project about halfway. Apply medium lapping compound sparingly to the work. Spot in a straight line, overlapping each spot half its diameter. Rinse in kerosene.—*Randolph Lucas, Richmond, Va.*



How to Renew Knurling Tools. When packed with metal particles, knurling tools cannot produce good knurls. Soak in lacquer thinner for half an hour and brush or blow them clean. Re-oil before use.—*C. H. Hubachek, East Haven, Conn.*

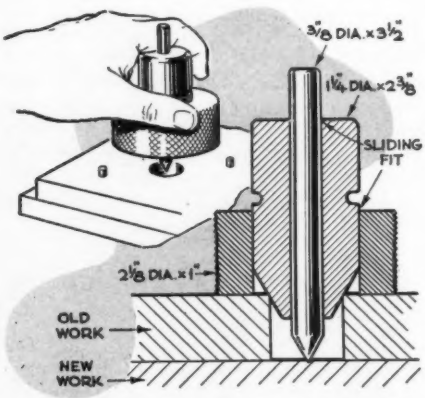
Please turn the page for more shop tips

MORE SHOP TIPS



How to Resharpen Dies. Worn button dies can be reconditioned with a lap turned in an electric drill. Either a standard adjustable-sleeve lap or a homemade one can be used.

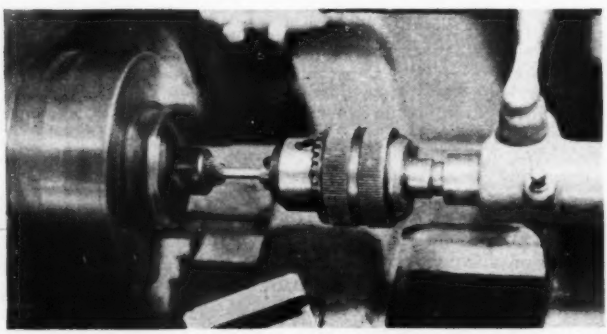
For the latter, turn brass, copper or soft steel to the size of the chip-clearance holes in the dies. Form helical grooves by cutting coarse-pitch right- and left-hand screw threads in the lathe. Then split the lap lengthwise. Spring the ends apart to a tight fit. Charge heavily with rather coarse compound. Work the lap back and forth as it turns in the die. When finished, wash the die in kerosene or fuel oil to remove all compound.—*H. J. Gerber, Stillwater, Okla.*



Punch Transfers Holes. Laying out centers from holes is easily and accurately done with this transfer punch. The tapered body is set into the hole, the collar slid down onto the surrounding surface, and the punch struck. Its mark will be accurately centered under the hole.

Bore the collar to a good finish, and turn the body a close sliding fit in it. The outside, tapered end, and bore should all be machined at one chucking to insure concentricity. The center punch should be hardened. Dimensioned as shown, the device can be used in holes from ½" to 1¼" in diameter. For smaller ones, reduce the diameter but not the length of the parts.—*C. W. Woodson, East Aurora, N. Y.*

Ball Cutter for Boring. For increasing the bore in a gear hub to fit a ⅝" shaft, I mounted a ball cutter in the lathe as shown in the photo at right. It did the job in one pass. The tailstock must of course be accurately aligned for such a job, and the work well centered, or the cutter will bore an oversized hole.—*John Tavian, Mentone, Calif.*



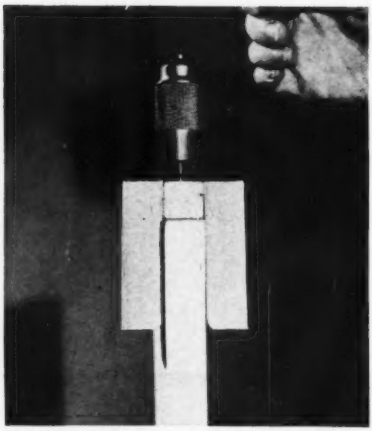
Squeeze Bottle Squirts Plaster into Wall Cracks

A SOFT-PLASTIC ketchup or mustard dispenser is perfect for applying small amounts of plaster or cement. Squeeze it and the pointed spout will fill cracks, wallboard joints or crevices around door and window frames. If you want to increase the flow, cut the spout down. The material can be washed out.—*E. P. Graff, Ridgewood, N.J.*

Rolling Car Mixes the Paint

THE next time you buy paint, make the stirring easier by letting your car do most of the work. Put the unopened cans in a large carton in the trunk where they can roll around as you drive. Keep them in the car until you are ready to start your painting job.—*Bill Copeland, Sarasota, Fla.*

DO IT THE EASY WAY



TO KEEP THE DRILL SQUARE when making a hole in the end of a board, slip on a U-shaped guide. Make it from wood scraps.

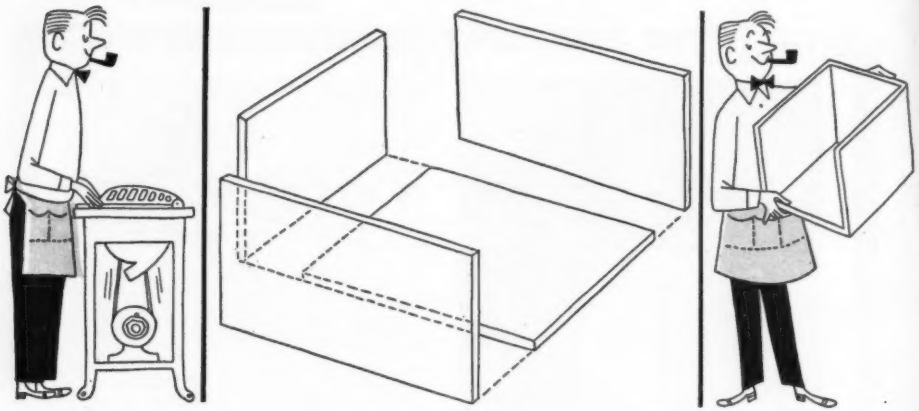
DROP A SMALL PART? Place a flashlight on the floor. Look for the part's shadow.

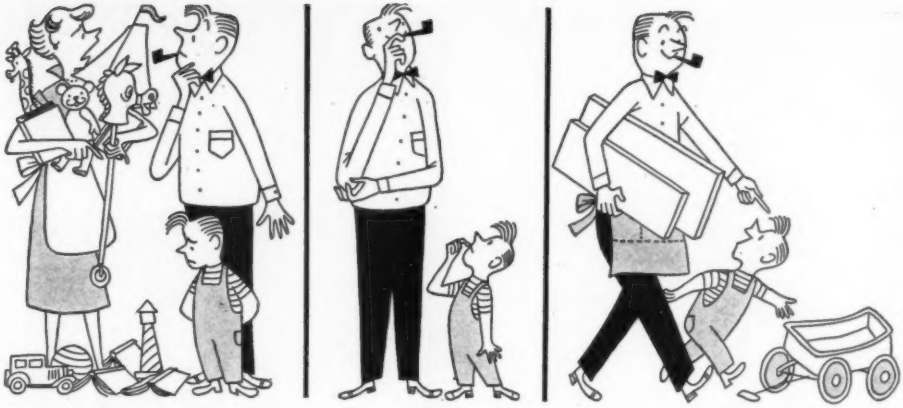
DON'T WASTE TIME cleaning a good brush if you do small lettering jobs daily. Use a cotton-tipped swab. Then discard it.

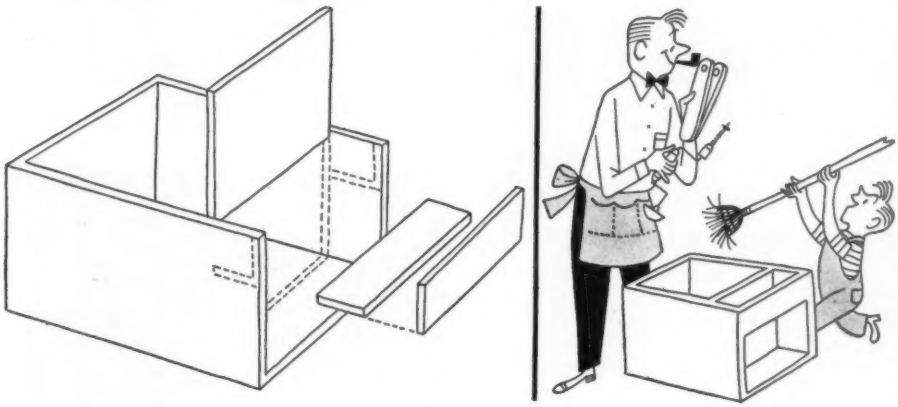
A CARPENTER'S TRICK will help you drive nails into hardwood. Lubricate them with wax crammed into a handle hole.

By Roy Doty

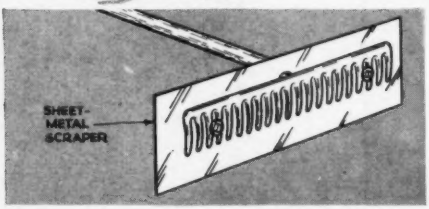
Wordless Workshop







Next Month: A shelf table for the sportsman



Garden Rake Does Snow Duty

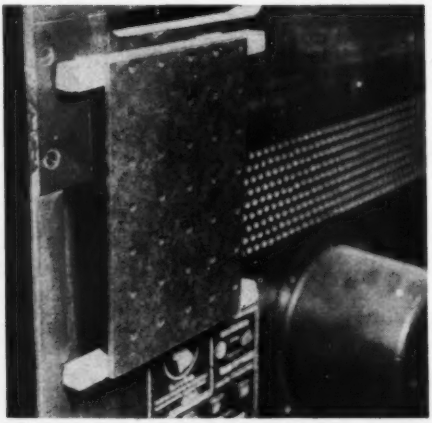
CONVERTED to a snow scraper, your rake becomes a year-round tool. Cut a hole in a rectangle of sheet metal and push it over the handle. Using large washers on the prongs, bolt it on.—*R. E. McCune, Harvard, Mass.*

Clothespin Rack Hangs Skirts

YOU will be a hero to the women in your family if you make a set of hangers that will keep skirts from becoming wrinkled. Cut dowels to required length, drill for hooks cut from wire hangers, and mount clothespins, driving nails through the springs.

Remove Your Watch First

BE SURE to take off your wrist watch when you work with paint remover. Spattering will pit a plastic crystal badly—as the home handy man above discovered too late.



TV Slot Holds Program Notes

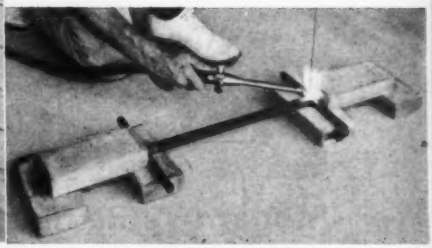
YOU can keep TV magazines in a pocket on the back of your set. Screw a piece of material such as Masonite Peg-Board to two strips of wood and glue it on. The perforated board will not cut off air.

Tip on Treating a Typewriter

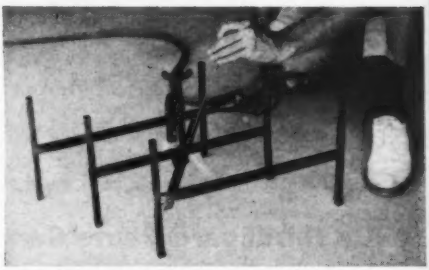
IF YOU store a portable typewriter in its normal writing position, its delicate parts are less likely to shift out of alignment.

How to make

A Modern Fireplace Grate

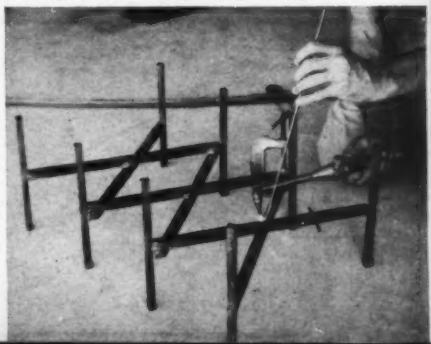


1 THREE SUB-ASSEMBLIES shaped like the letter H are welded together first. Notice how bricks are used here to hold the parts.



2 A DIAGONAL CROSSPIECE ties the three sub-assemblies together. End welds have already been made and clamps removed.

3 AS FINAL STEP, a leg and crosspiece are added to each end of grate. The pantograph-shaped assembly is now ready for painting.

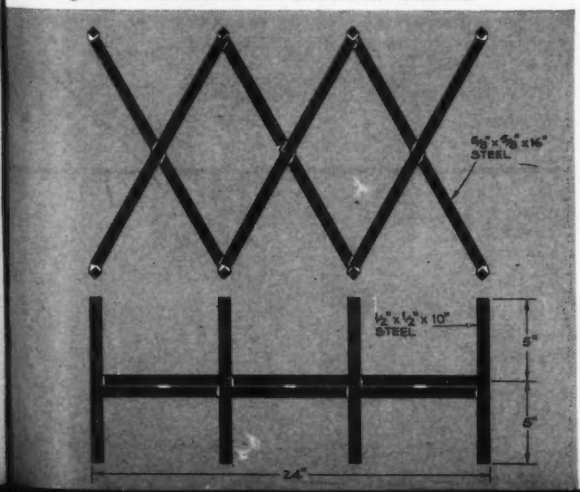


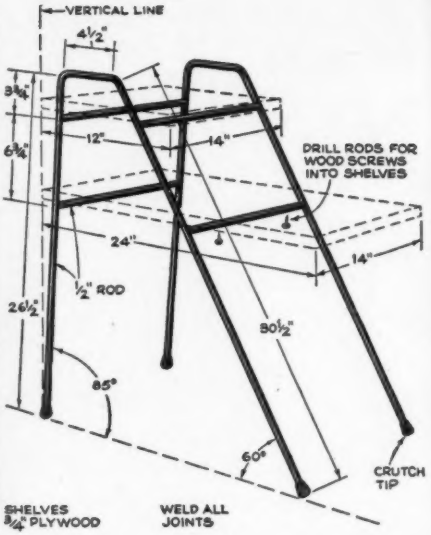
By John Rogers

WELDING is required to make this modern fireplace grate, but you don't have to *own* a welding outfit. You can hacksaw the parts to length and have the rest of the job done at a local welding shop for two or three dollars.

Mild-steel bar stock is used. You need eight 10″ lengths of ½″-by-½″ stock for legs, six 16″ lengths of ⅝″-by-⅝″ stock for crosspieces. After the welding is completed, finish the job by giving the grate a coat of flat black paint.

SHAPED LIKE A PANTOGRAPH, the grate is designed to substitute for traditional andirons.





Modern Table Made from Birch and Wrought Iron

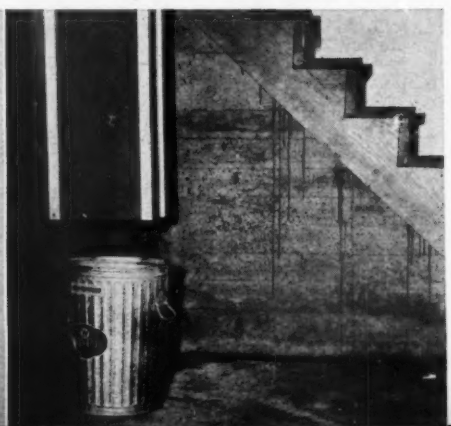
HERE'S a clean-cut blend of natural wood and wrought iron that fits in well with both modern and traditional furniture. The sides of the end table are A-shaped frames bent from ½" steel rod. You can form the angles in a vise with a hammer, pulling on the legs for leverage.

If equipment isn't available to weld the crossbars, you can have the job done inexpensively. Welding is preferable to bolts that may permit wobble. I used ¾" birch plywood for the shelves, trimmed at the edges by gluing on 1/32"-by-3/4" solid-birch strips. Score the plywood heavily with a sharp knife before sawing and you'll find that the face veneer won't chip.

My favorite finish—by which I mean easy to apply—is two coats of floor sealer, buffed smooth between coats with steel wool. Brush on the second coat liberally, wait five to 10 minutes, then rub vigorously with a rag soaked in turpentine. When dry, rub to a deep luster with fine steel wool and paste wax.—*Frank E. Price, Reno, Nev.*

Hardboard Chute Carries Kitchen Trash to Basement Bin

A CHUTE leading from the kitchen to a basement trash container will save the housewife many steps. Such a chute can often be built in a stairwell as shown below. In this case, the chute was made of tempered hardboard stiffened with 1"-by-2" wood strips at the corners. The wood door was housed in a framework of 1"-by-3" lumber.



How to Make Traverse Rods from Wood

PLYWOOD CARRIERS slide smoothly along a wood bar to open and close these window drapes in the author's home. The cornice was hung from a one-by-two cleat on the ceiling.

By Edwin M. Love

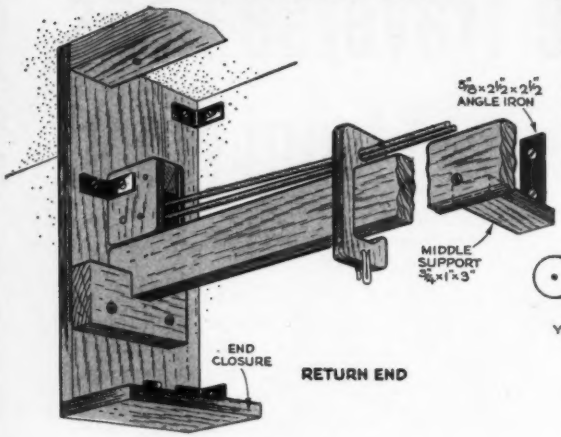
TRAVERSE rods develop exasperating faults. My wife complained that the carrier slides snagged on the rod joints and jammed when the drapery hooks jumped out, which is often. Finally, when the draw cords of an 18-foot window broke as she tugged at them, she ordered me to fix them.

I was fed up with stretching my arms and craning my neck, trying to thread drapery hooks into carrier eyes. Repeating the cycle by installing new commercial rods did not appeal to me. Then came an inspiration. Why not build new rods in my shop? Since wood slides nicely on wood, I could make the carriers and rods of wood. I did, and my creation works like a charm. I am now convinced that it will be a long time before my spouse is irked again by balky, snagging drapes.

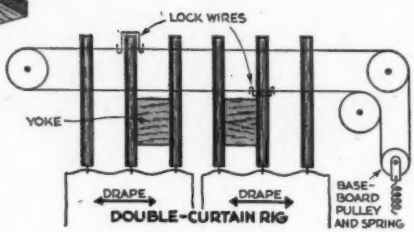
Hardware for the job consisted of small steel awning pulleys from a dime store, plus nails, screws, stove bolts, and angle irons. Plywood went into the carriers and brackets, but ¼" hardboard was chosen for the cornice fronts because there's no grain for the paint to raise.

Building the rods involved a production run in carriers. The other work was simple

How the traverse rods work



SINGLE OR DOUBLE CURTAINS can be installed on this homemade wooden traverse rod, the double ones meeting at, and drawing away from, the middle of the window expanse. Notice that the two carriers at the leading edge of each drape are yoked together with a wooden block and that the inner member of the double carrier is wired securely to the draw cord.



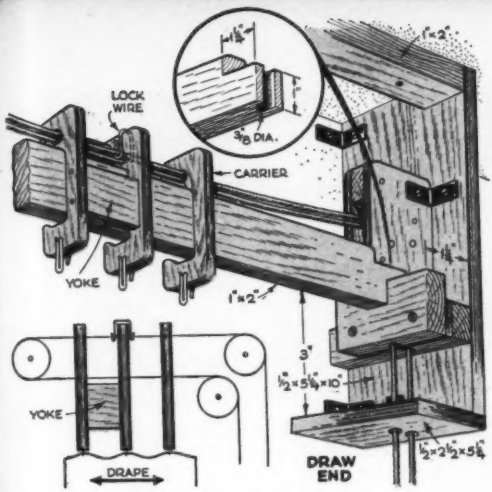
carpentry. Since my windows are high, the fronts of the cornices were hung from a ceiling cleat, the ends extending over the end brackets to hide the joints. Wooden blocks, bored and countersunk, were glued ⅞" below the upper edge of the hardboard facings, forestalling interference with the cleat. The blocks, coated with white plastic glue, were rubbed onto the back and left to dry. Screws were then run through the blocks into the ceiling cleat.

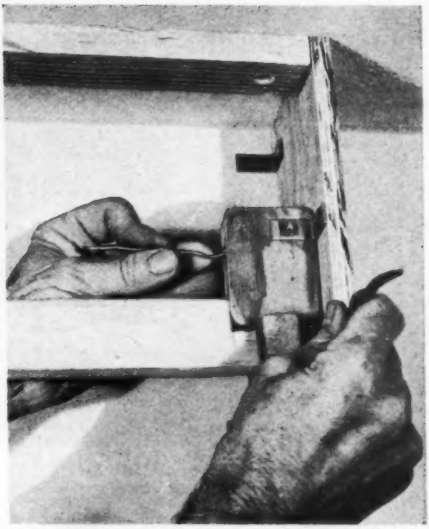
Installation pointers to keep in mind as you work follow:

Make the carriers on a mass production basis, that is, cut all the blanks first.

How you make the carriers

STACK SIX BLANKS in an assembling jig made by nailing two pieces of plywood to a squared piece of two-by-four. The blanks are 2"-by-3¾" pieces of ¼" plywood. Cut a tracing pattern from cardboard (or make up one carrier), drop it on top of the pad of blanks and trace around it. Then, holding the pad firmly in the jig, drive two four-penny finishing nails into the center (waste) opening. Remove the pad from the jig, take it to the drill press and drill the holes

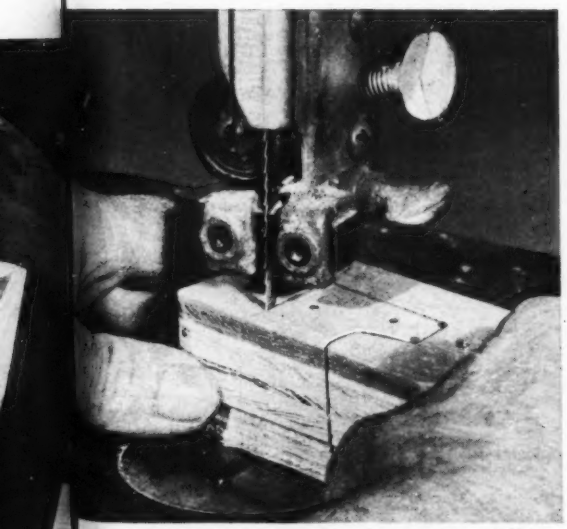




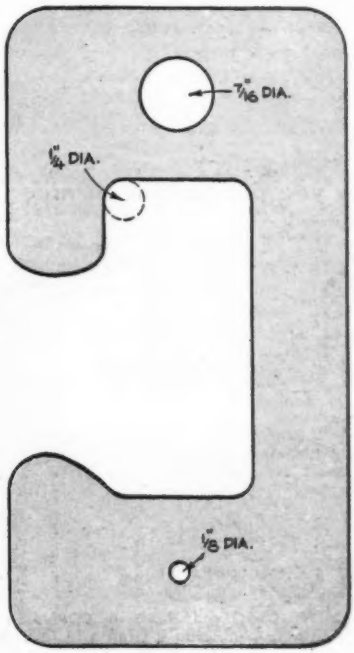
THREAD PULL CORD through the pulleys with a piece of wire solder. Tie a string to loop in solder, and tie the string to the end of cord.

Then assemble them into pads of six blanks each as shown in the photos. You then can drill all the holes of a particular size in the carrier pads at one time without changing bits.

When the carriers have been sanded, suspend each one from a wire hook and dip it into a can of shellac thinned

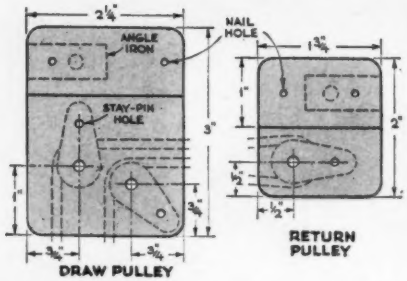


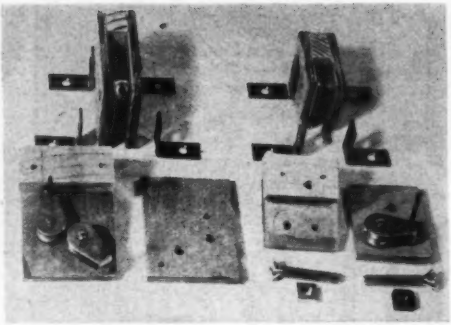
shown on the pattern. After sanding all edges smooth and rounding them, cut out the center of the carriers with a 1/8" band or scroll saw. The carriers will drop apart as sawing is finished. If you want a super job, sand the center edges.



ACTUAL SIZE

How you assemble brackets





THREE AWNING PULLEYS are needed for each traverse rod installation, two for the draw end, one for the return. Assemble the pulleys as shown between sheets of ¼" plywood, using spacing blocks equal in thickness to the pulley shells. Cut off the projecting nail points and rivet the ends. Attach the angle irons with small bolts run through the bracket.

enough to run off freely. Hang it on a cord to dry.

Dimension the wood blocks that yoke together the leading pair of carriers on each drape to suit the pleats.

Attach the pulley brackets and rod supports to the cornice ends and screw the latter to the wall, using plaster anchors where necessary.

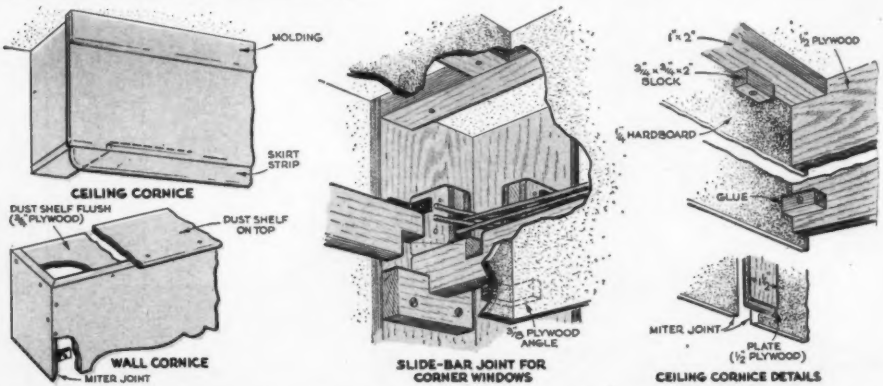
After shellacking the one-by-two bar, rub the top with paraffin. For smoother action also coat the inner edges of each of the carriers.

To thread the draw cord through the pulleys, bend a loop in the end of a piece of wire solder, tie a string to the loop and hammer the loop flat. Tie the string to the end of the draw cord and shove the solder through the pulley.

For single drapes leave the cord ends hanging; for a double draw, pass the cord around a baseboard pulley mounted on a spring.

It is customary to place draw cords at the right end of a window, or at the outer ends of corner windows.

How you put up the cornice



TWO METHODS OF MAKING A CORNICE are suggested here—hanging it from a ceiling cleat or bracketing it to the wall with a dust shelf on top. If the ceiling is irregular and the top edge of the cornice board doesn't fit against it, use a molding strip. If more drape coverage is needed, add a skirt strip inside the cornice. When the cornice is faced with hardboard, glue it to blocks spaced every 18" for a neat installation. Should wide windows require splicing the board, miter the joining ends and glue a plywood plate behind the joint. Box-joint in the center drawing above shows how the author held together two cornice boards in a free-hanging joint to hide the pulleys attached to his corner installation. END

Towel Quiets Electric Shaver Used by Early-Morning Riser

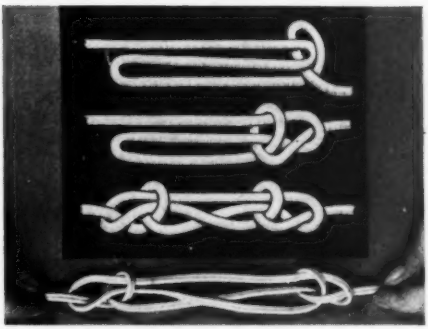
THE buzzing of an electric shaver early in the morning or late at night may disturb a light sleeper. When you need to get out of the house before the family arises, wrap a small towel or facecloth around the shaver. It will cut the noise.

Restoring Lock Tension

FRICTION catches on down-swinging doors, such as those on cabinets, clothes chutes and the like, sometimes wear smooth. One or two chromed, roundheaded thumbtacks stuck in the edge of the door often will restore tension.

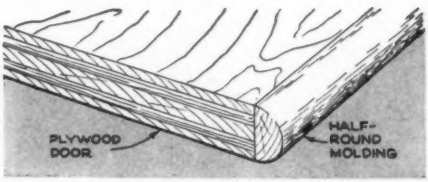
Bumpers Hold Logs in Barrow

HAULING logs in wholesale lots is no problem for Clvde W. Bailev of Wellsboro, Pa. By adding bumpers to his wheelbarrow, he can stack logs much higher. And they *are* bumpers: the end sections of an old Chevvy bumper. The four bolts holding them are the original ones from the car.



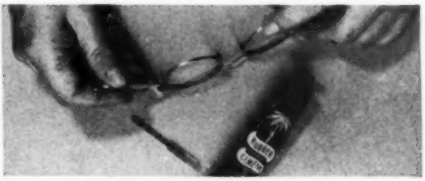
Navy Hitch Shortens Cord

YOU can shorten electric cords, rope or lines without cutting them if you use a Navy hitch. The illustrations above show the steps. If you want to shorten the line only temporarily, don't pass the ends through the end loops; then the whole knot can be shaken loose when desired.



Molding Finishes Plywood Edge

TO INSTALL a plywood sliding door on a closet, I worked out an easy finish for the vertical edges. By gluing and nailing on ¾" half-round molding, I got a workmanlike job.—*N. J. Mettelka, Manitowoc, Wis.*



Cement Holds Eyeglass Screws

THE hinge pins in eyeglass frames have a tendency to work loose. To anchor a pin, fill the sockets with rubber cement, and screw the pin in tight. If it's ever necessary, you can easily remove the cement.

10 Extra Uses

By William B. Eagan

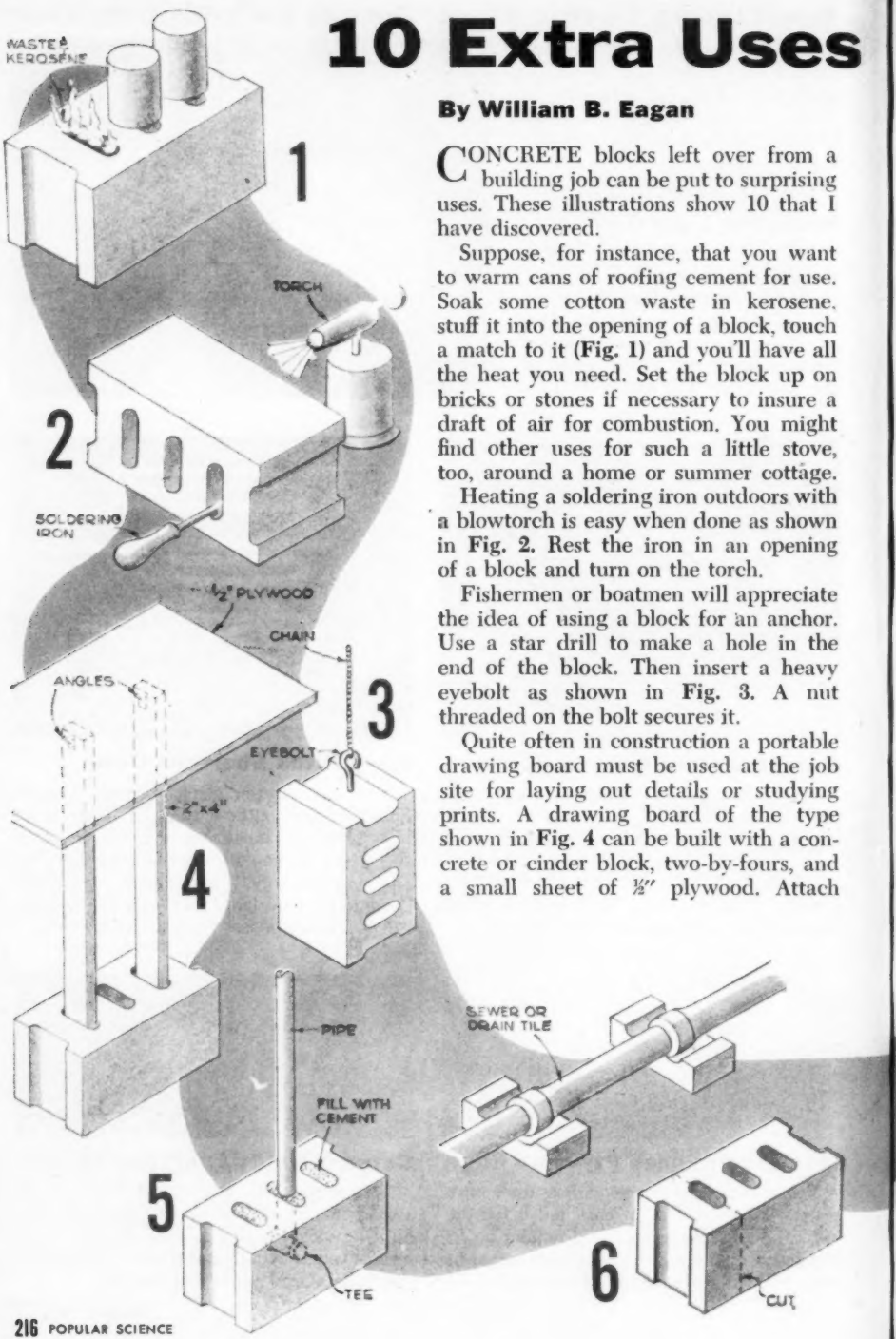
CONCRETE blocks left over from a building job can be put to surprising uses. These illustrations show 10 that I have discovered.

Suppose, for instance, that you want to warm cans of roofing cement for use. Soak some cotton waste in kerosene, stuff it into the opening of a block, touch a match to it (**Fig. 1**) and you'll have all the heat you need. Set the block up on bricks or stones if necessary to insure a draft of air for combustion. You might find other uses for such a little stove, too, around a home or summer cottage.

Heating a soldering iron outdoors with a blowtorch is easy when done as shown in **Fig. 2.** Rest the iron in an opening of a block and turn on the torch.

Fishermen or boatmen will appreciate the idea of using a block for an anchor. Use a star drill to make a hole in the end of the block. Then insert a heavy eyebolt as shown in **Fig. 3.** A nut threaded on the bolt secures it.

Quite often in construction a portable drawing board must be used at the job site for laying out details or studying prints. A drawing board of the type shown in **Fig. 4** can be built with a concrete or cinder block, two-by-fours, and a small sheet of ½″ plywood. Attach



for Concrete Blocks

the plywood to the uprights with two angle irons. Wedge the ends of the two-by-fours into the end block openings.

A good dirt tamper is often needed around a home. A block will provide one. Insert a length of 1″ or 1½″ pipe, with a tee screwed on one end, into the middle opening of the block (**Fig. 5**). Then fill all three openings with cement.

A workman whom I hired to install drain tile used sections of concrete blocks to support the tile. Each block was split through the center of each opening (**Fig. 6**) and the pieces made a cradle base for the tile to rest on.

The housewife will appreciate the two items illustrated in **Fig. 7** and **Fig. 8.** Painted white, filled with soil and buried halfway in the ground, blocks will serve as handsome flower planters. Use them for boundary markers along driveways and walks and around ponds. Because of their weight, they make useful and novel umbrella holders when painted and decorated. Felt glued to the bottom of the block will prevent marring the floor.

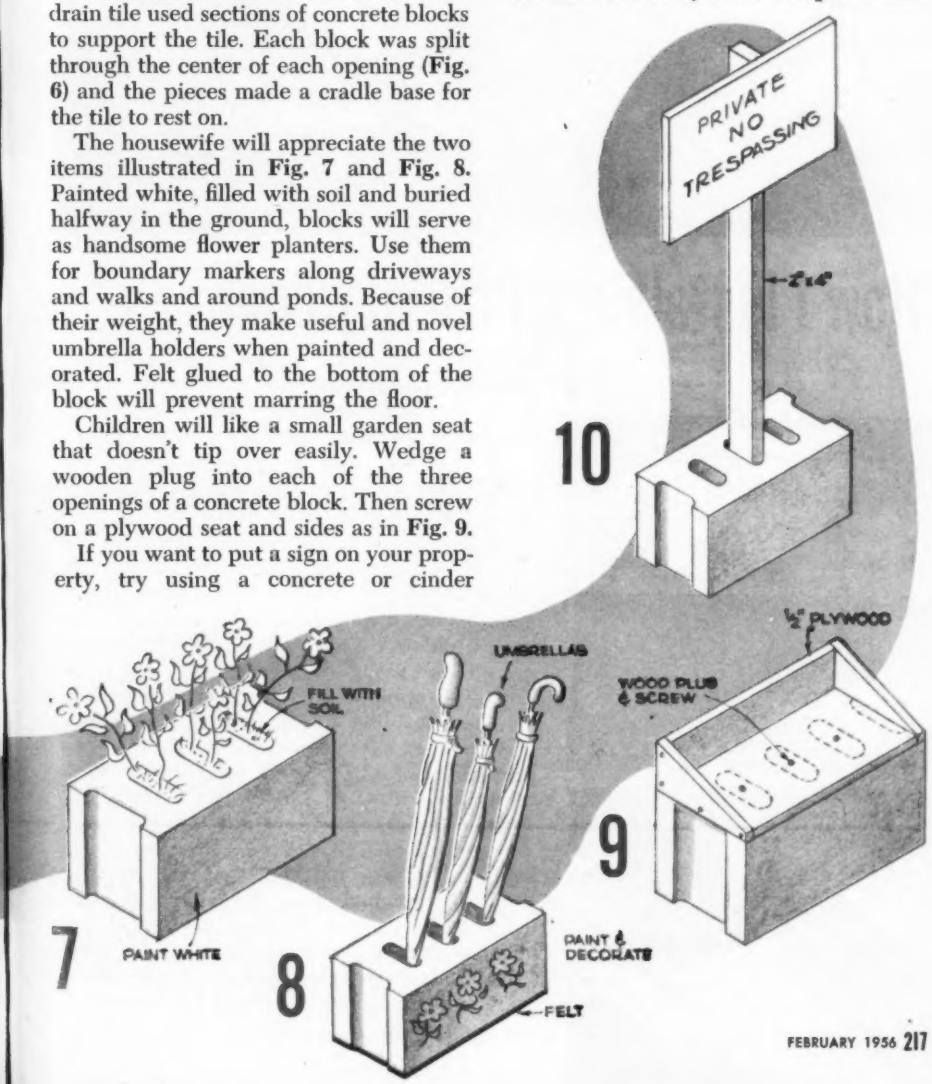
Children will like a small garden seat that doesn't tip over easily. Wedge a wooden plug into each of the three openings of a concrete block. Then screw on a plywood seat and sides as in **Fig. 9.**

If you want to put a sign on your property, try using a concrete or cinder block as its base, **Fig. 10.** It will save you the trouble of sharpening and driving the sign post into the ground.

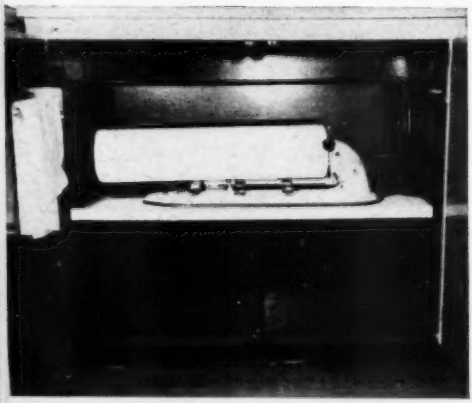
And here are two more ideas:

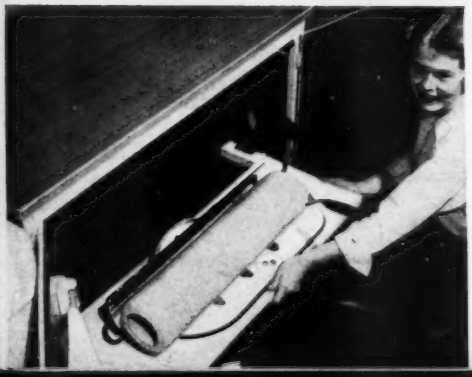
For a quick and easy outdoor fireplace, place two blocks on the ground with a grille across them.

If you have a brook to bridge, place concrete-block piers on the banks and use cleated two-by-fours to span them.



How I Installed a Pop-Up Ironer





By Irving Lowell

THE gift of a portable ironer delighted my wife, but it gave me a problem. Where could I place the new appliance in an already crowded kitchen?

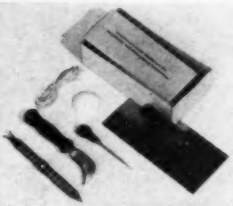
It would be very convenient, my wife suggested, if she could handle the mangle like an office typewriter—store it in a base cabinet, swing it out and up to table height. Could I do it? I could—and did. A counterbalanced mechanism for a swing-up typewriter platform from an office-supply house did the trick.

After deciding to locate the mangle in a double-door base cabinet, I removed the center stile, nailed it to one of the doors so that they would meet, and took out the shelves.

Only one change was required in the swing-up mechanism. The mounting brackets at each end had to be set farther apart so that they could be attached inside the ends of the cabinet. A welder cut the two horizontal bars and welded in bar stock to lengthen them. The regular typewriter platform was too short, so I made a longer one from 1⅛″ wood.

New for the Handy Man

1. Linoleum Made Easy to Install. Linoleum strips 24″ wide and a special tool kit enable you to tackle a floor job that is often left to a professional. Only the ends of these linoleum sheets need to be cut to size; the long edges come trimmed and matched to give a seamless appearance. There are 15 patterns in light and standard thicknesses and in various lengths.

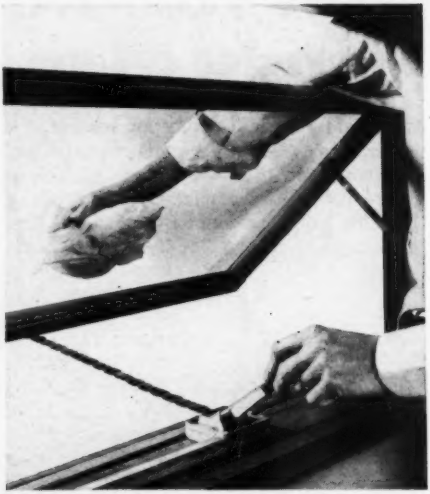


2. Folding Table Legs Come in Kit. Screw-on metal legs are now available in the fold-away bridge-table type. They are strong enough to support Ping-pong and picnic-table tops that you want to store flat when not in use.

3. Hopper Spreads Mortar Fast and Level. With one filling of this spreader you can lay two even strips of mortar (left) on the edges of 25 concrete blocks. It will also butter the ends (center) individually or in groups. Thickness of the mortar is adjusted by a height gauge on one end, resulting in a clean job (right). The steel hopper has two wooden handles so that it can be lifted or pulled in either direction over the blocks.

Please turn the page for more handy-man tips

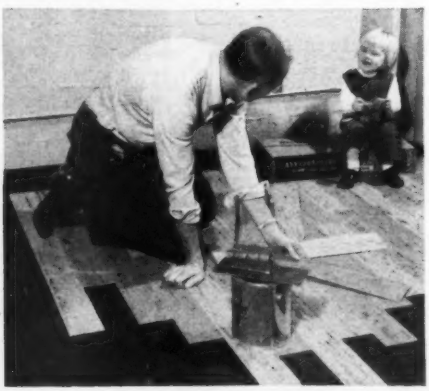
More Handy Man Tips



4. Chain Opens and Closes Window. A flexible crank chain that becomes rigid when extended opens or closes an awning-type window as chain is cranked out or back into its sill housing. Provided with the mechanism is a set of hinges that slide in grooves to angle the window from the top.

5. Three Ladders Combined in One. This magnesium ladder is a lightweight extension ladder when you swing its hinged back frame up and lock it at 180°, or a stepladder when it is swung down and held with cross braces. The back telescopes so that you can set the ladder up on steps.

6. Earphone Finds Water Leaks. You don't have to be a Sherlock Holmes to locate a leaking water pipe. A sensitive earphone held against a pipe spots it for you by transmitting the sound to your ear through a lead button in the diaphragm.



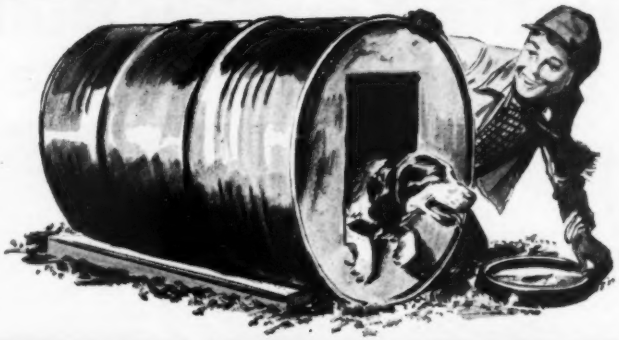
7. Floor Tiles Resemble Boards. Asphalt tiles 4″ wide by 24″ long simulating oak, walnut, maple or driftwood are being used to produce the effect of wood flooring. You lay them as ordinary tiles on wood or concrete in random-plank or parquet designs.

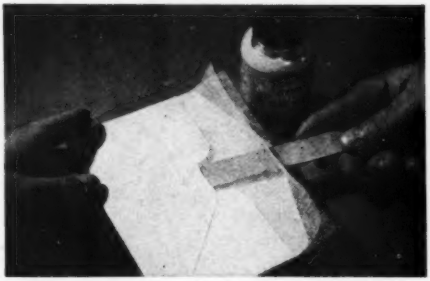
Further information on the products shown on this and the preceding page can be obtained from: 1. Armstrong Cork Co., 1010 Concord St., Lancaster, Pa.; 2. Jondonic, Inc., 224 West 7th St., St. Paul 1, Minn.; 3. Engel Enterprises, Box 225, Day Road, Cincinnati 31, Ohio; 4. H. S. Getty & Co. Inc., 3348 N. 10th St., Philadelphia 40, Pa.; 5. Moss Products Co., 2610 W. Berwyn Ave., Chicago 25, Ill.; 6. Aqua Survey & Instrument Co., 2518 Leslie Ave., Cincinnati 12, Ohio; 7. The Tile-Tex Division, Flintkote Co., 1232 McKinley Ave., Chicago Heights, Ill.

You Can Make a Snug Canine Quonset from an Oil Drum

A GASOLINE drum with a rectangular hole cut in one end makes a cozy, weathertight doghouse. Cold-chisel the doorway out and file or bend the metal to eliminate ragged edges.

Use plenty of straw bedding to keep the new tenant warm and comfortable.—*E. V. Reyner, Townsend, Mont.*





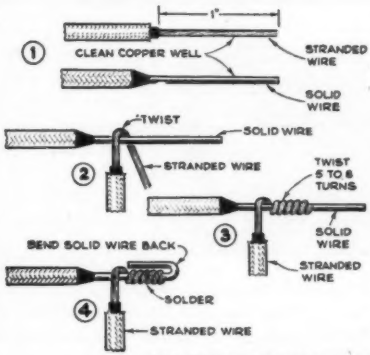
Lining Strengthens Envelope

A CHEESECLOTH lining lessens the chance of coins or other small objects breaking through a mailing envelope. Apply thin coating of glue on the inside with a flat stick; then use the stick to push the material in place. Mark the envelope "hand stamp."

Clothesline Is Weatherstrip

A PIECE of clothesline can be used as substitute weatherstripping. Press it firmly into place and tack or staple it to the frame of the window or door. Then apply a coat of paint. Such line might also be used in some circumstances as a substitute for calking.

ELECTRICAL, FIXTURE SPLICE



A FIXTURE splice is used to attach stranded flexible wires, such as those found on home fixtures and electrical appliances, to solid power wires.

The solid wire remains straight until the stranded wire has been coiled around it. Then the solid wire is bent back against the coil and the entire splice made secure by flowing solder over and around the connection.

Wrap the joint well with rubber insulating tape and then friction tape. Be sure to lap the tape well over the frayed end of the stranded-wire insulation to prevent further unraveling of the covering.

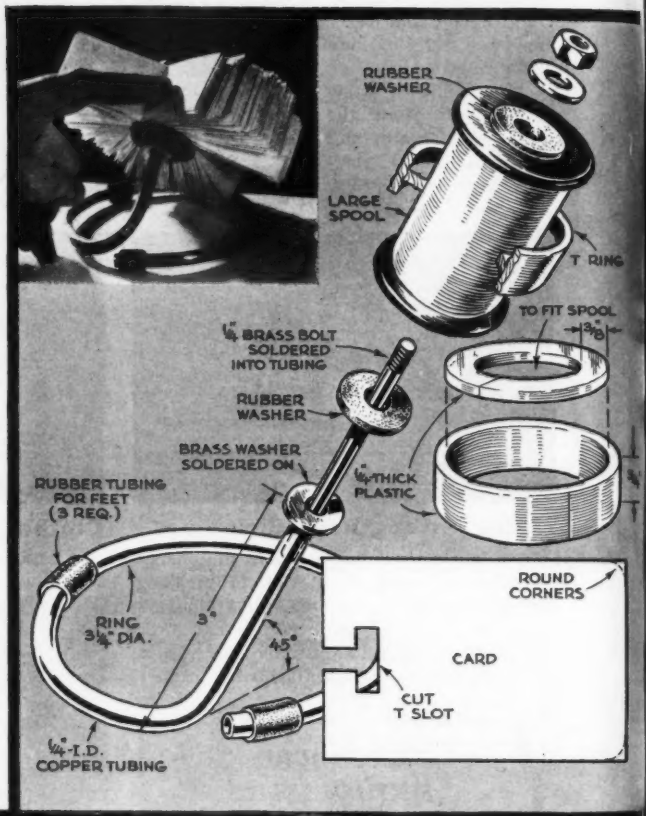
FOR YOUR *POPULAR SCIENCE MONTHLY* INFORMATION FILE.

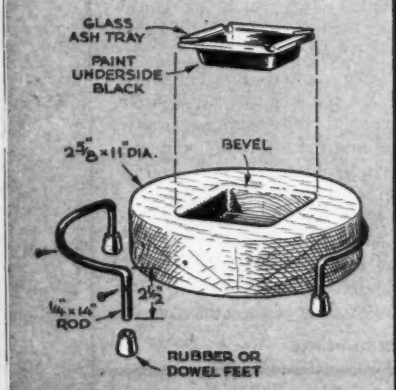
Items You Can Build for the Home 'Office'

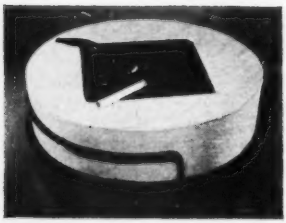
1 Find phone numbers quickly by spinning the rotary file at right. The hub is a large carpet-thread spool that revolves on a bolt. The bolt is soldered into a ring-shaped stand made of copper tubing that cocks the file at a convenient angle.

To hold the cards to the hub, build up a T-shaped ring from strips of clear plastic (you can get small scraps at hobby shops for little or nothing). Soften the strips in an oven, curve them to fit the spool snugly, and fasten them together with plastic glue.

From standard 3″-by-5″ index cards cut smaller cards to fit the width of the spool, with a matching T-shaped slot in one end so that they'll hook over the ring on the hub. Make up a set of slightly longer cards and letter the protruding ends to mark the alphabetical divisions. By turning the axle nut, you can adjust the spool's tension between the rubber washers.—*J. M. Finn, Pittstown, N. J.*





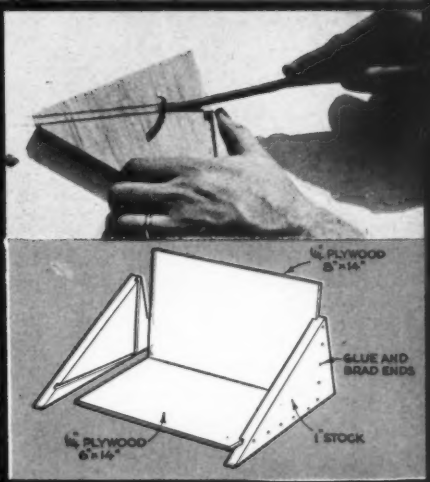


2 A big ash tray can be made by bandsawing or turning a base from a piece of three-by-twelve. Cut a recess in the center for an inexpensive glass tray available at dime stores. Sand the wood well and finish with stain and lacquer.

Form the legs from two 14″ lengths of ¼″ rod, shaping them to fit the curve of the wood disk. Bend down 2½″ lengths at 90° on each end, and drill the rod for small wood screws to fasten the legs to the bowl.

3 **Desk-top rack** holds books at a distinctive cocked angle, easy to see and reach. It will also neatly store kitchen cookbooks or shop manuals.

You can cut the two triangular end pieces from a single 6″-by-9″ board, as shown in the sketch. Dado the ¼″-by-¼″ grooves on a circular saw, or chisel them out between parallel saw cuts as in the photo. Fit the ¼″-plywood back and shelf into the grooves, and then glue and brad the rack together.—*Earle W. Thompson, Los Angeles.*



4 **Wall file** sorts mail, bills, messages and other important papers where you can see and get at them easily. For a kitchen nook, use an inexpensive metal tray like this for a decorative backing. For a den or shop, make a plaque from wood or hardboard.

For the clips, glue up two rows of square wood clothespins, overlapping the ends about 2″. Set the rows 3¼″ apart and screw them to the tray or backing panel.—*Walter E. Burton, Akron, Ohio.*

Gun Muzzles Kept Dust-Free

A FINGER cut from a glove and slipped over the muzzle of a gun keeps out dust when the gun is stored upright in a rack.

Felt Pad Does the Sticky Work

CEMENT or tape a piece of felt to the bottom of a mucilage bottle. It will absorb excess mucilage and make a fine smoothing pad for paper after glue is applied.—*Glen F. Stilwell, Manhattan Beach, Calif.*

Sticking an Unstuck Corner

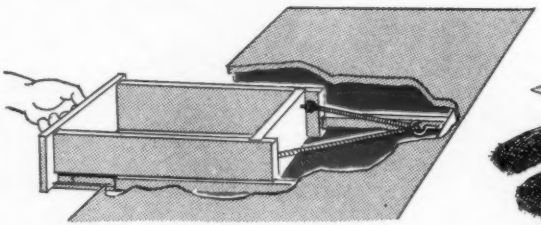
IF THE corner of a label, stamp or pasted-on photo or clipping won't stick, moisten the gummed flap of an envelope and supply adhesive by pressing the unstuck corner on it as illustrated in the photo above. Then draw the envelope flap out quickly.

Light Cord Anchors Projector

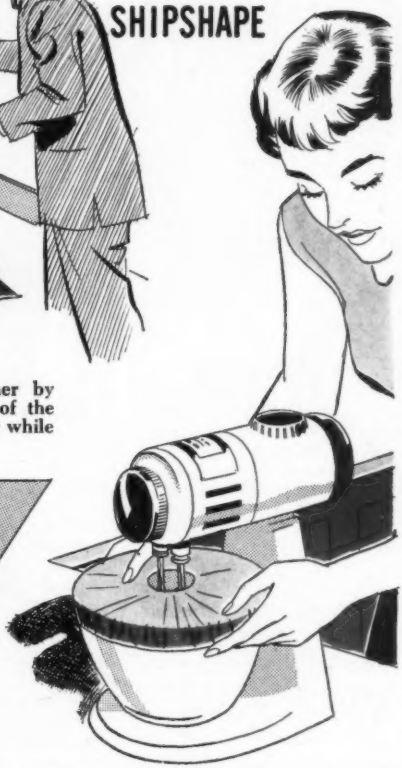
A SLIDE viewer or other electrical equipment is in danger of being yanked off a table by anyone tripping over the electric cord. You can prevent this by wrapping the cord a few turns around the leg of the table to arrest the pull on the appliance.

KEEPING THE Home SHIPSHAPE

PROTECT WALL-TO-WALL CARPETING in bad weather by spreading a large, heavy-plastic tablecloth in front of the door. Have your family and guests stand on the cover while they close umbrellas and remove their rain gear.

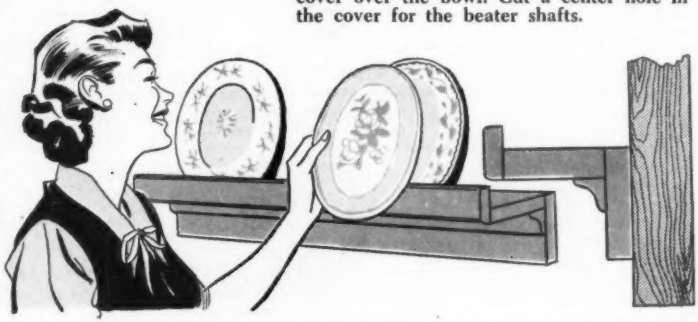


DRAWERS CLOSE EASIER if you put springs on their backs. Loop a screen-door spring over a cup hook centered in the back of the cabinet. Then hook the ends of the spring in screw eyes that are placed on each side of the back of the drawer.



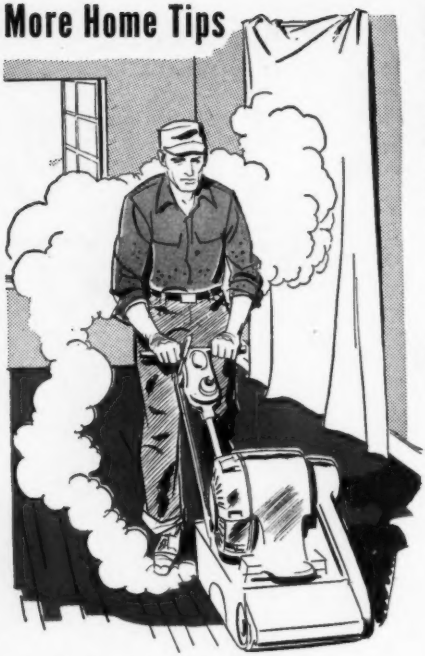
SPLASHING BY YOUR MIXER can be prevented by placing an elastic-edged plastic cover over the bowl. Cut a center hole in the cover for the beater shafts.

A DISPLAY RAIL FOR PLATES can be made from two one-by-threes nailed together and then nailed to wall studs. Support the joint with glued and bradded cove molding, and add 1" base molding for trim. Countersink and fill nail holes, sand, and stain or paint.

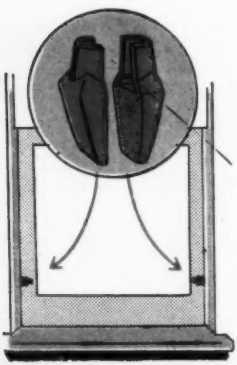


Please turn the page for more home tips

More Home Tips

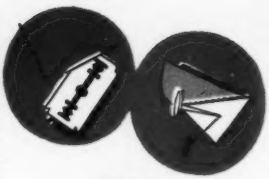


CATCH THE DUST when you sand or scrape a floor by hanging damp sheets over the doors. The sheets will keep fine dust from floating into adjoining rooms.



RUBBER WEDGES made by slicing a slip-on eraser in half will stop irritating rattles, such as a loose window, or level small household appliances. Eraser halves glued at intervals along the stop strip of a banging door will deaden the noise.

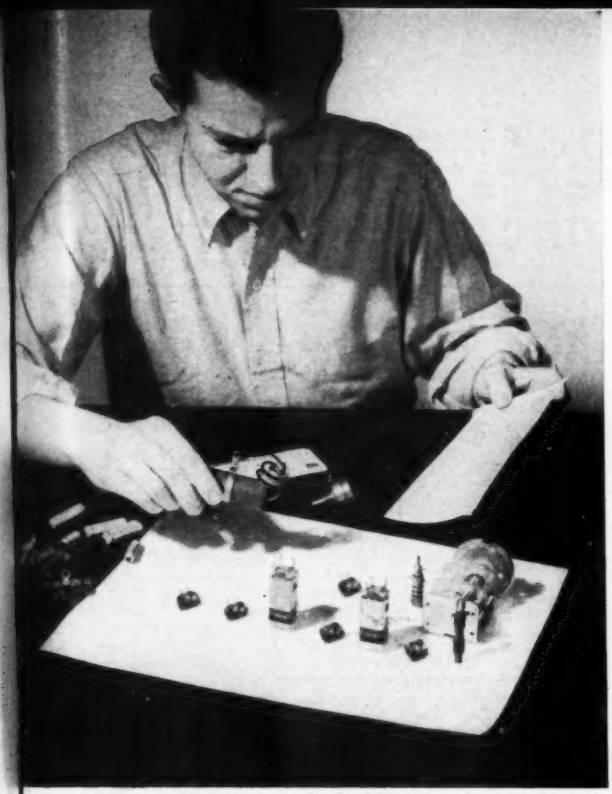
HIDE A NAIL HOLE in a papered wall by precutting a flap to cover it. Using a razor blade, make a small V-shaped incision. Lift the flap to drive in the nail. If you later remove the nail, paste the flap down again.



SHOPPING FOR FAUCET WASHERS will be easier the next time you need them if you note the sizes on slips of paper and tape these under kitchen and bath fixtures.

A PLANT TABLE made from a revolving office chair simplifies sunning house plants on all sides. Remove the chair back and attach a rounded piece of plywood to the seat. Cut this bigger than the seat to provide room for more pots. Finish to suit your taste.

A BROKEN POT-LID KNOB can be replaced by a wooden spool held on with a bolt, nut and washer. Peen the end of the bolt so the nut will stay tight and the knob secure.



SECRET OF SUCCESS in radio building is to make your mistakes on scratch paper. The first of four major steps is to plan the layout of major parts on paper (above), following the diagram. This also helps you determine chassis size.

Are you looking for an interesting new hobby? Here's what you should know about

Getting Started in Radio Building

By J. W. Rocke Jr.

BUILDING small radios is a rewarding hobby. Getting started, however, may be difficult because you don't know the little points that writers of manuals and how-to articles often take for granted.

You'll need to learn, first of all, how to understand schematic diagrams. The diagram of the AC-DC superheterodyne receiver on the following page is your key to this understanding. (The diagram is for study only and is not intended for use in building a set.)

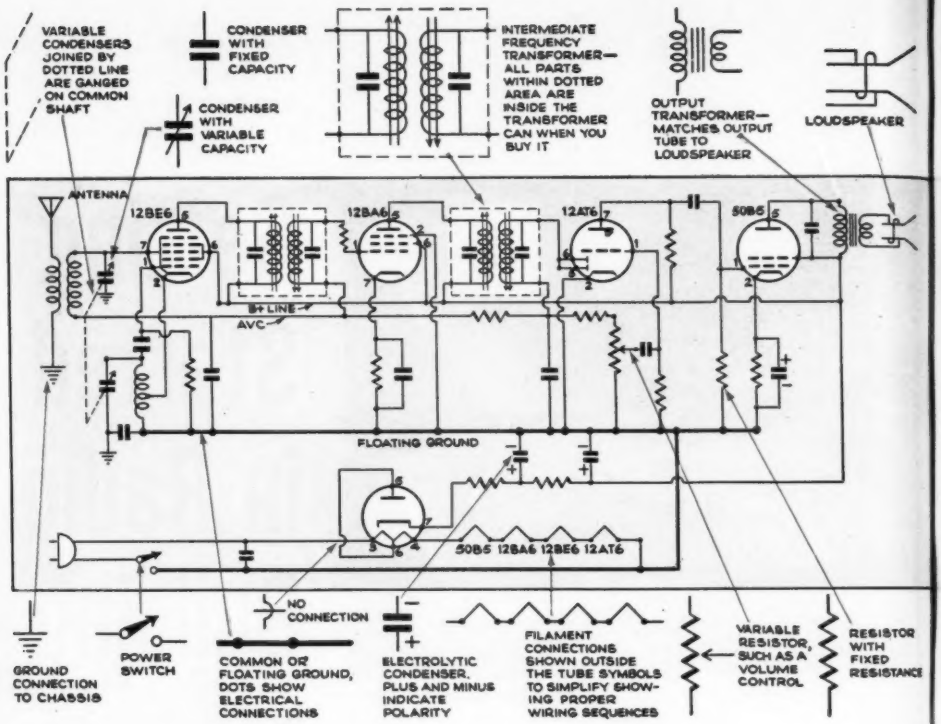
Plan the chassis arrangement. The all-important first step in working from a diagram is to fix the location of each major part. You can do this by placing the parts on a piece of wrapping paper.

It's best to line up tube sockets in the order shown on your schematic diagram. Place the intermediate frequency (IF) transformers between the tubes, as on the schematic. Locate the volume control and variable condenser where you want these shafts to come through the finished cabinet. Antenna and oscillator coils go in the easiest wiring positions.

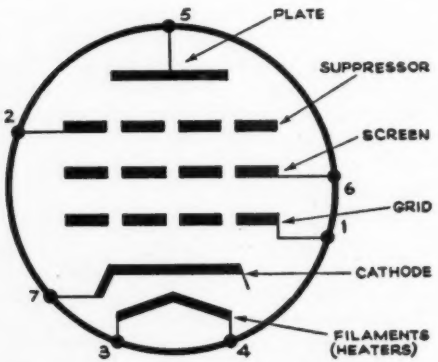
Don't bother to find spots for the small parts yet. Small resistors and condensers will usually fit in as you wire.

Convert the schematic diagram into a pictorial, or working, plan by penciling in trial connections between the parts. The idea is to find the most direct and practical wiring plan that will avoid critical wiring mistakes—such as using unusually long IF grid and plate connections. It is usually a good plan to keep the parts in a straight line. Try several arrangements until you find one that will give the most direct wiring paths for the critical plate and grid leads.

The chassis. The parts arrangement you decide on will determine both size


VARIABLE CONDENSERS JOINED BY DOTTED LINE ARE GANGED ON COMMON SHAFT
CONDENSER WITH FIXED CAPACITY
CONDENSER WITH VARIABLE CAPACITY
INTERMEDIATE FREQUENCY TRANSFORMER—ALL PARTS WITHIN DOTTED AREA ARE INSIDE THE TRANSFORMER CAN WHEN YOU BUY IT
OUTPUT TRANSFORMER—MATCHES OUTPUT TUBE TO LOUDSPEAKER
LOUDSPEAKER
ANTENNA
12BE6
12BA6
12AT6
50B5
B+ LINE
AVC
FLOATING GROUND
50B5 12BA6 12BE6 12AT6
NO CONNECTION
GROUND CONNECTION TO CHASSIS
POWER SWITCH
COMMON OR FLOATING GROUND, DOTS SHOW ELECTRICAL CONNECTIONS
ELECTROLYTIC CONDENSER. PLUS AND MINUS INDICATE POLARITY
FILAMENT CONNECTIONS SHOWN OUTSIDE THE TUBE SYMBOLS TO SIMPLIFY SHOWING PROPER WIRING SEQUENCES
VARIABLE RESISTOR, SUCH AS A VOLUME CONTROL
RESISTOR WITH FIXED RESISTANCE

and shape of the chassis. On your first attempt it's well to make the radio chassis fairly large for easy wiring. While shortness of plate, grid and B-plus wiring is stressed in radio construction, it doesn't necessarily mean crowding the parts to extremes. Crowding can actually be detrimental.



TUBE SYMBOL represents the working parts (elements) of a tube. These are connected to pins, identified by number. Find the corresponding numbers on a tube socket by looking at the underside; start counting at the space (or key) and go clockwise to the desired pin.

Before installing tube sockets in the chassis give a little thought to their orientation. If you rotate a socket a quarter or half turn from its random position you can often prevent an awkward wiring situation.

Chassis wiring. Where do you begin wiring the chassis? Might as well start with the filament terminals (or lugs) on the tube sockets. They are good practice for the tougher jobs ahead.

First take a look at the tube symbols on the schematic. Notice that no filaments are drawn inside the circles; they are set off by themselves at the bottom of the schematic, along the power cord. (This is a common practice to simplify diagramming and wiring a set.)

The filaments, unlike other tube elements, do not get involved with the

signal; they simply provide a supply of electrons for the tube to use. Follow the schematic wiring order to minimize hum. In an AC-DC set like the one shown, filaments are strung along in series, like the cheaper Christmas-tree lights. (Not all sets have series-wired filaments; in the AC-DC set, series wiring eliminates a power transformer otherwise necessary.)

For best set operation, the other tube elements should be wired into the shortest possible signal path, the way they are usually shown in the schematic.

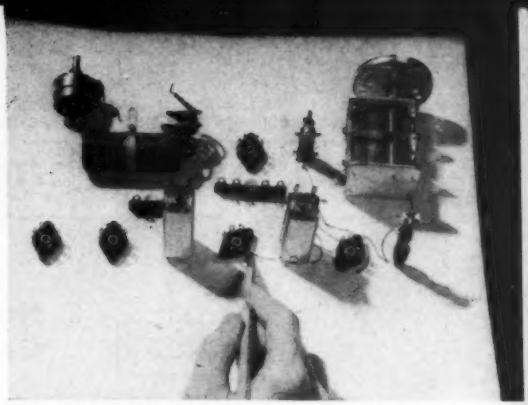
It's a good idea to wire one section at a time, to prevent mistakes. I have found, however, that wiring critical parts is easier if you make all IF transformer-to-tube connections before adding the required resistors and condensers.

Early in the hookup work you will be looking for spots to make common connections. Your pictorial layout will help by showing up usable parts terminals. You can use soldering lugs on major parts and appropriate tube-socket lugs for most of your common connecting points. But don't tap into a wire running between terminals—it makes a poor mechanical connection that could vibrate loose. If you have a junction that does not come together on a lug, mount a separate terminal strip to provide a tie point.

Soldering wires to common-connection lugs is much easier if you do it only after you're sure no more wires join together at that point. This prevents having to solder a connection more than once.

Using spare parts. Spare-parts boxes and inexpensive surplus parts are invaluable to the experienced radio man but can be a headache to the novice builder. Too often these parts carry no identifying code to show how they should be wired into a circuit. In selecting oscillator, antenna, RF and IF coils, for example, it pays to buy new parts—unless you know for certain the values and terminal connections of the parts in question.

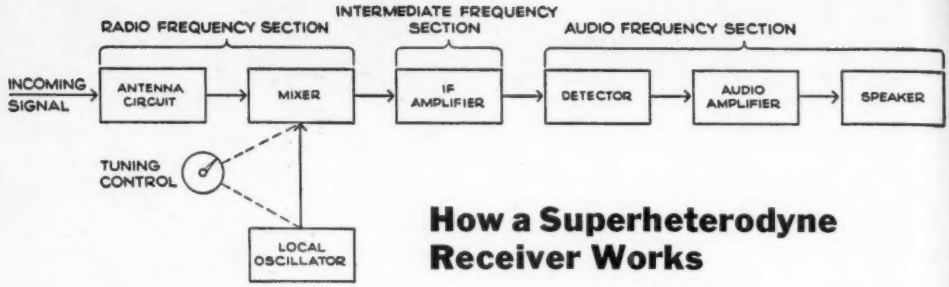
Resistors and fixed condensers carry a color code for ready identification, so they are an asset to any spare-parts box. Unless quite an assortment is at hand,



SECOND PLANNING STEP is to pencil trial connections between the parts as they lie bottom-side-up. Instructions with them identify the terminals. Keep the wiring paths short.

FIRST MECHANICAL STEP is to lay out the chassis and cut holes for the parts. Follow the arrangement made on paper and mount all parts securely before soldering connections.

SECOND MECHANICAL STEP is wiring. Do filaments first, twisting the leads together where possible. A terminal strip makes a handy mount for power resistor and also provides tie points.



How a Superheterodyne Receiver Works

WHEN you tune in a radio station on a superheterodyne receiver, you're actually tuning two circuits in the set simultaneously. A radio-frequency (RF) circuit picks out the signal you want from all those being broadcast. A local oscillator circuit generates a second signal that is 455 kilocycles higher than the broadcast signal.

The two signals meet inside a mixer tube and react with one another to produce an intermediate frequency (455 kc.) signal. This change in the radio-frequency part of the signal does not affect the audio part that contains music or speech.

It's the use of a fixed intermediate-frequency (IF) section that explains superhet popularity. Instead of selecting and amplifying broadcast signals at many radio frequencies, the superhet converts all RF signals to a single frequency (the IF). Interfering signals are blocked in the process and the initial critical amplifying is always done at the same frequency. Key parts can therefore be chosen for best performance at a single frequency.

Now sharper and stronger from its passage through the IF section, the signal is split into its radio- and audio-frequency parts by the detector tube. The RF is discarded and the audio is further strengthened in the audio amplifier. A loudspeaker converts electrical energy into sound.

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however, you are not likely to be lucky enough to pick out all the values called for by a specific plan. You can sometimes substitute values near the ones called for, if you don't mind correcting a bad guess now and then.

In selecting a suitable substitute, remember that manufacturers allow a tolerance for small resistors and mica condensers. The average tolerance on these parts is 10 to 20%. For that reason a resistor or condenser having a value close to that called for may work.

Aligning the set. Don't be disappointed if your receiver doesn't work the first time you turn it on. Wiring and assembly may be perfect, but you won't hear a sound unless all major parts function as a team—unless they are in alignment. Once you understand how a superheterodyne receiver works you will see why alignment is so important, and why salvaged parts are poor economy for the beginner.

From the summary above of how a superhet works, it's easy to see why the values of parts in the set are critical. Antenna and local oscillator circuit parts must team up to produce an unvarying 455 kc. difference. The IF transformers must both be aligned (by means of their tuning slugs) to this intermediate frequency, and they must properly match the other circuit components. Obviously, parts of unknown value are simply an added liability.

To align, or tune, all the RF and IF sections of the set, the novice builder will probably do best to take it to a serviceman who has the equipment for such a job.

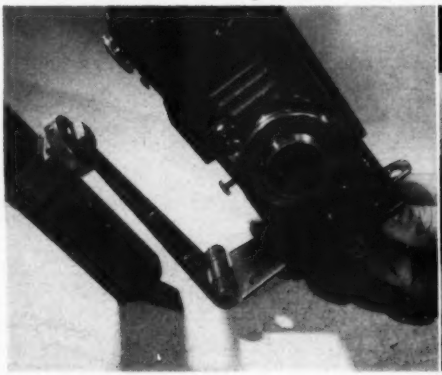
Chances are that your first or second home-built set will receive strong local stations—at least if you've selected the major parts from the designer's parts list. New IF coils are aligned by the manufacturer. They should require very little adjustment in the completed receiver, provided the rest of the set is in balance. You can usually improve alignment by following the instructions given with the original diagram. END

Four Photo Tips

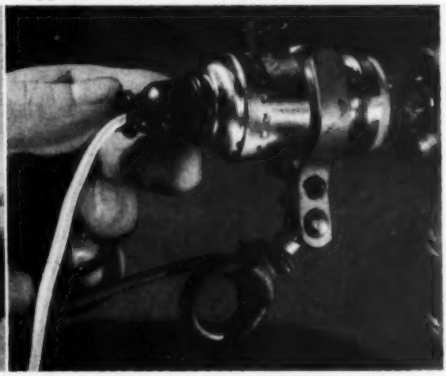
1 RESTORE GRIPPING POWER to the clamp on a photoflood reflector with heavy rubber bands. Twist them around the clamp arms in place of tubing that is rotted or worn.

2 ADJUST TRIPOD LEGS easily by slipping tight-fitting crutch tips—with ends cut off—over the knurled locking sleeves. Then the knurls can't dig into your fingers when you loosen a jammed sleeve. Uncut tips on the leg ends set them for steady shooting.

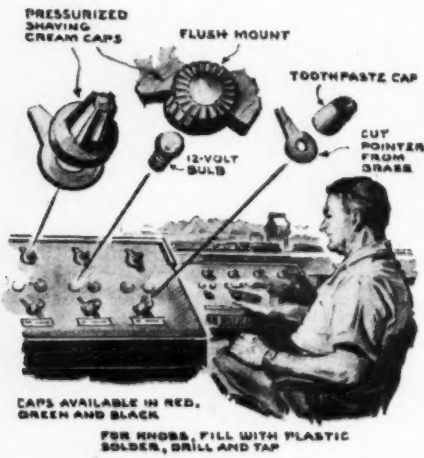
3 AN ADJUSTABLE FLASH-GUN BRACKET can be made from a strap hinge. Stiffen the hinge by hammering the pin ends. Insulate the bracket with fiber washers if the gun case is metal.

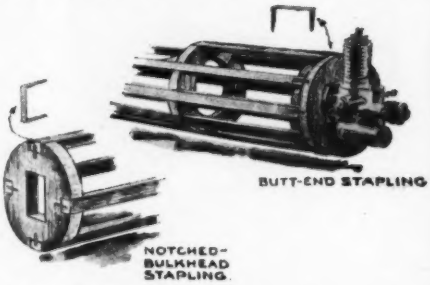


4 FRAYED LAMP CORDS can be avoided if you push a rubber nipple over the threaded pipe on a photo-lamp socket. An auto distributor-cap nipple just fits, and it's heat resistant.



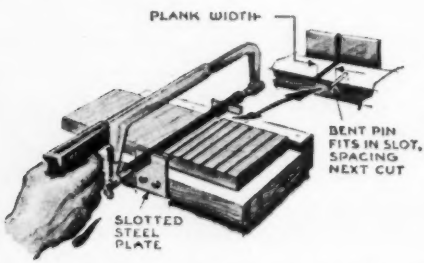
Useful Ideas for the Modelmaker


PRESSURIZED SHAVING CREAM CAPS
FLUSH MOUNT
TOOTHPASTE CAP
CUT POINTERS FROM BRASS
12-VOLT BULB
CAPS AVAILABLE IN RED, GREEN AND BLACK
FOR KNOBS, FILL WITH PLASTIC SOLDER, DRILL AND TAP

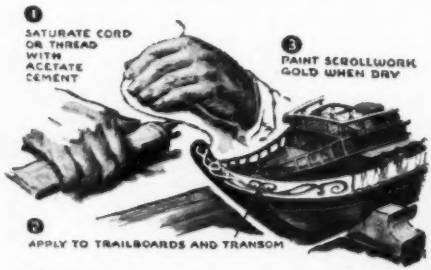


STAPLES Engine mounts won't tear free from the fuselages of your model planes if, after using cement for assembly, you reinforce all critical joints with staples.

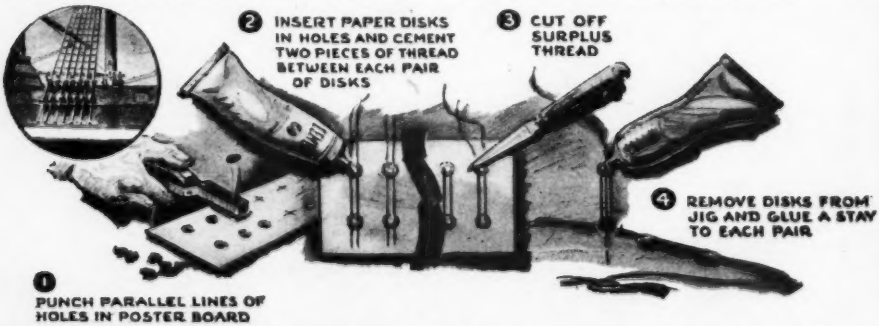
CAPS Don't throw away plastic caps. You can use them for everything from wheels to headlights. On a model railroad control board, they make handsome dials and color signals.



PLANKING Here's a handy way to simulate planking on a large model. Make a miter box for your hacksaw. Then lay out the work so that the cuts run with the grain.



SCROLLWORK It takes a clever woodcarver to whittle scrollwork on a ship model. Using thread or cord instead gives professional results in much less time.


2 INSERT PAPER DISKS IN HOLES AND CEMENT TWO PIECES OF THREAD BETWEEN EACH PAIR OF DISKS
3 CUT OFF SURPLUS THREAD
4 REMOVE DISKS FROM JIG AND GLUE A STAY TO EACH PAIR
1 PUNCH PARALLEL LINES OF HOLES IN POSTER BOARD

DEADEYES Why get the shakes threading deadeyes for a ship model? Punch them from poster board and the perforated sheet becomes an accurate spacing jig.

Some scrap wood, containers and batteries show

How to Take Water Apart

By Andrew Pfeiffer

THE chemical formula that nearly everybody knows is H_2O. If you're the Missouri type and want to see for yourself that heavy, wet water is, strangely enough, a combination of two light and dry gases, it is fairly easy to take some water apart. You will get (by volume) two parts of hydrogen gas and one part of oxygen gas—H_2O.

You can take water apart the same way that it was first done 150 years ago by two Englishmen, Nicholson and Carlisle. They connected a battery to two electrodes in water and found that hydrogen bubbled off one electrode and oxygen bubbled off the other.

A convenient rig to

use is a simple one that is described in a book put out by the United Nations Educational, Scientific and Cultural Organization. It is intended to promote scientific training in underdeveloped countries, and it is ideal for quick construction at home. Even youngsters can build it.

What you need. For electricity, an automobile storage battery is fine, but several No. 6 dry cells (1½ volts) connected in series will do nicely, too. The electrode tips are bits of a carbon rod pulled out of an old flashlight cell. These are supported on plastic-insulated No. 14 solid-copper wires 9″ long. You can scrounge the wire from an odd length of BX or Romex cable. You also need two Fahnestock clips or binding posts.

The water holder is a 24-ounce clear-plastic freezer container. You catch the hydrogen and oxygen in test tubes (the glass tubes that toothbrushes and cigars often come in are okay).

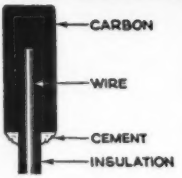
Make the stand from scrap wood, cut as shown in the photograph and assembled with screws. Three of the little wooden blocks position the tank. The other two hold the electrodes and can be marked negative (where hydrogen collects) and positive (where oxygen collects).

Electrodes. Hacksaw the flashlight cell lengthwise and carefully remove the carbon rod. Cut two ¾″ pieces off the rod, clean them well, and drill a ½″-deep hole in the end of each with a No. 52 drill. Do not drill through.

Cut off insulation for ⅜″ on one end of each of the electrode wires. Insert this end into the carbon, making sure that the insulation butts against the carbon. Coat the joint with household cement. (The experiment will not work if this is not done carefully.)

Bend the wires to shape and loop their free ends, from which 1″ of insulation has been removed, under the screws holding the connector clips.

The experiment. If you put this all together and start the juice, nothing will happen. Water is a remarkably poor conductor of electricity. But you can



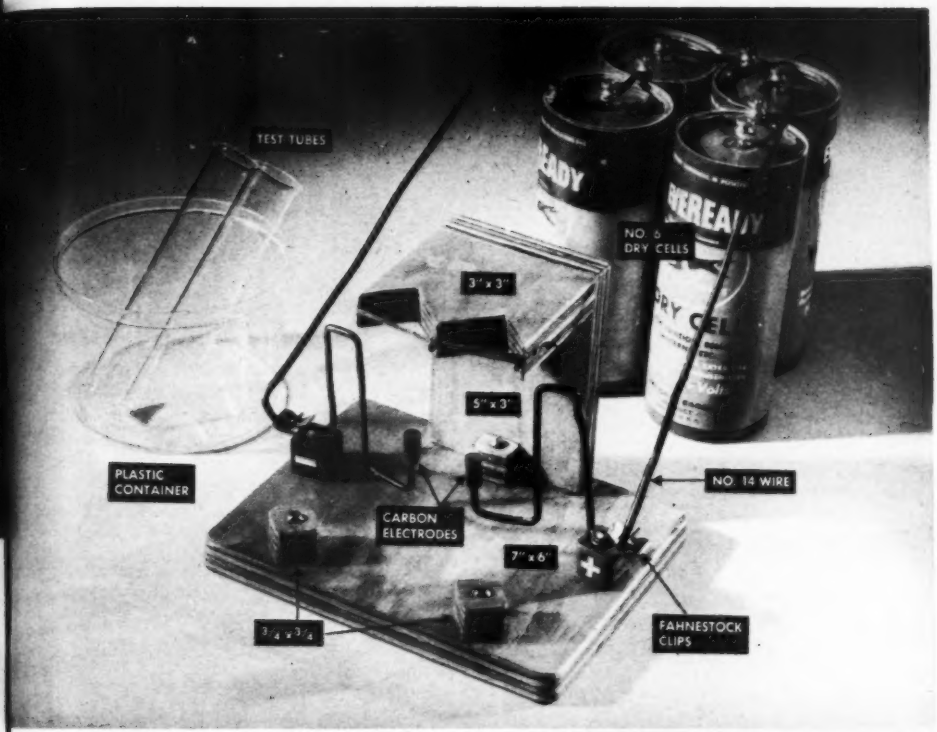
ELECTRODES, which feed electricity into water, are made from carbon rod of a flashlight battery. Piece of rod, drilled ½″ with No. 52 drill, is slipped over bared end of wire. Seal the connection as shown in the sketch (left).

quickly make it conductive by adding some washing soda (three tablespoons to a quart).

The tank should be filled until the electrodes are submerged ¼″. Set up the test tubes this way: Pour the soda-and-water solution into each tube until it overflows. Put a square of paper over the tube mouth, invert the tube, submerge the mouth in the tank, let the paper fall away (fish it out later), and carefully slip the tube over the electrode without allowing the mouth to break water. If you do this properly, your tubes will be totally water-filled, without air bubbles that would confuse the results. Rubber bands, looped over brads, hold the tubes in the notches of the stand.

Now you are ready to start perking. Hook the negative battery terminal to the negative electrode, positive terminal to positive electrode.

Almost immediately you will see



ODDS AND ENDS make apparatus. The stand shown was built of ¾" plywood, but other scrap wood can also be used. Dimensions should be varied to suit the water container.

streams of tiny bubbles rising in each tube. The hydrogen comes off much the faster, making its tube appear milky.

The proof. After a while, you can see that the hydrogen tube (negative) contains approximately twice as much gas as the oxygen tube. Only approximately, because much more oxygen than hydrogen dissolves in the water and disappears from view.

How do you know that it's hydrogen in the negative tube, oxygen in the positive? Test them.

Remove the negative tube from the stand, keeping it inverted and allowing the water to spill out. (Hydrogen, being lighter than air, stays inside the inverted tube.) Bring a flame—a burning soda straw—close to the tube mouth as you turn the tube up. The hydrogen will flow up and out, mixing with air. When the hydrogen-air mixture reaches the flame, you should get a very satisfactory *pop!*

MINIATURE EXPLOSION proves that larger quantity of gas (from negative electrode) is hydrogen. Hold a small flame near mouth of tube and tilt the tube up. It will pop noisily.

To check on the oxygen, remove the tube, keeping it inverted and spilling the water. Instead of a flame, use a glowing ember—a pine sliver, say. Insert it up into the inverted tube. It should burst into flame when it meets the oxygen.

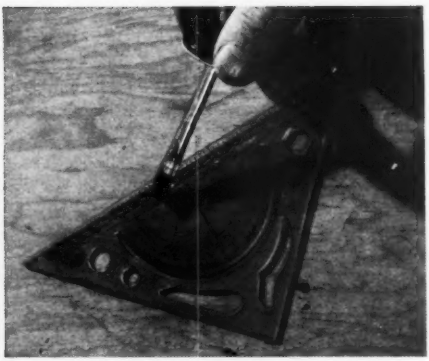
Okay? Water *is* H_2O. END

Why Not Save Ice-Cream Sticks for Spreading Glue?

THE flat sticks on which ice cream is frequently sold make good glue spreaders. Have members of your family save them. You can put the sticks to use handily when you are applying thin layers of glue on paper, cardboard, or other surfaces.

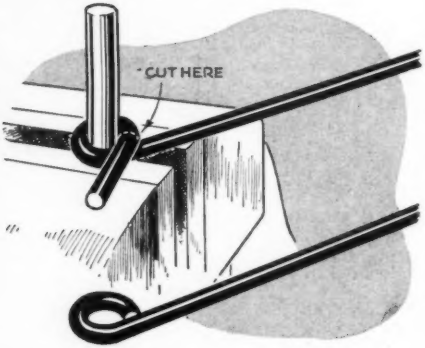
Lead Shot Is Mixer

IF YOU keep a little lead shot in a bottle of white or colored drawing ink, the contents will mix with fewer shakes. The pellets speed up the process.



Adhesive Skidproofs Template

A COATING of rubber cement on the underside of a celluloid or plastic design template keeps it from sliding on the paper. Let the cement dry before using, so that it won't stick tight. Spots of masking tape will do, but rubber cement is transparent.

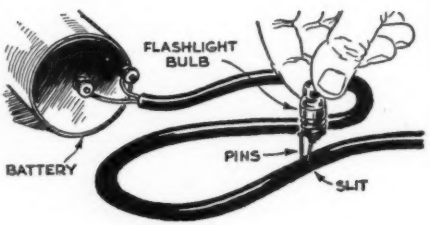


Rod Helps in Looping Wire

FORMING a loop on an end of heavy wire with pliers is a difficult job. It can be made easy if you twist the wire around a steel rod held upright in a vise. Cut off the excess length with a hacksaw and position the loop by gripping it with the pliers.

Tester Made from Pins Locates Break in Long Heavy-Duty Cord

INSTEAD of discarding a broken heavy-duty cord, I cut it at the break and had two shorter cords. I located the break by testing at 4' intervals: slitting through the insulation and inserting two common pins in the wires. With one end connected to a dry-cell battery, a 1½-volt flashlight bulb, touched to the pins, would light until the break was reached. Rubber cement and tape restored insulation.—*F. V. Betlach, Owatonna, Minn.*



Level Is Combined with Straightedge

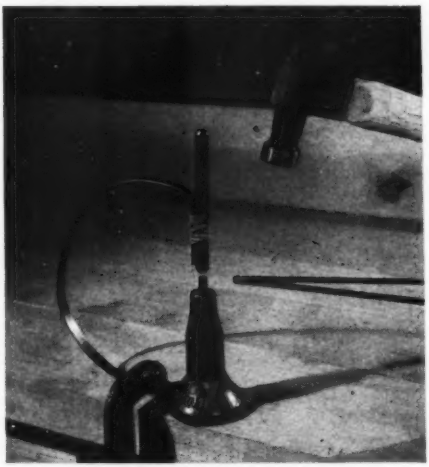
NEED a long level that will span the forms when you set them up for a concrete sidewalk? Attach a small level to a length of two-by-four for a combination level and straightedge. Bore two holes in the two-by-four to take cord or wire.

Card File Indexes Spare Parts

TINY replacement parts can be stored right on their own file card and indexed for ready location when needed. Glue a heavy-cardboard ring to the prepared card, put the parts in, and seal with a transparent disk.

Brush Makes Piggyback Scraper

GLUE a suede shoebrush to the back of a paint scraper to make a work-easing combination tool. A turn of the handle gives you the brush to clear off scrapings.

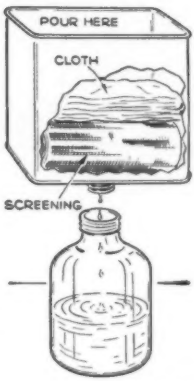


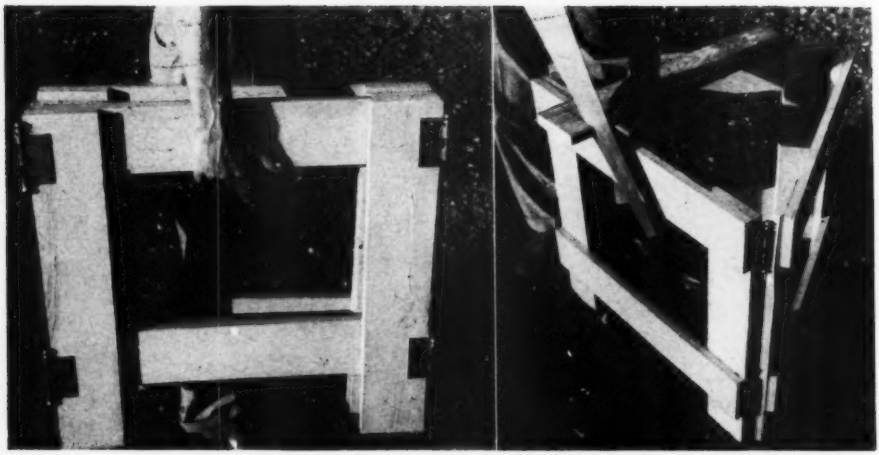
Iron Arm Speeds Riveting

ATTACHING the punch to a bent length of strap iron so that it is suspended over the anvil gives you a third hand when setting rivets. Clamp the arm to the bench, and hold the punch on with rubber bands. Both hands will then be free for the work and hammer, making the job much easier.

Tin Can Is Strainer and Funnel

A QUART can with a spout, a piece of rolled-up window screening and several thicknesses of cloth will strain paint solvent and other liquids for further use. Cut the bottom out of the can and fit the rolled-up screen over the spout end. Place the cloth on top. You may have to change the cloth to clean some fluids.—*C. H. Hardy, Los Angeles.*



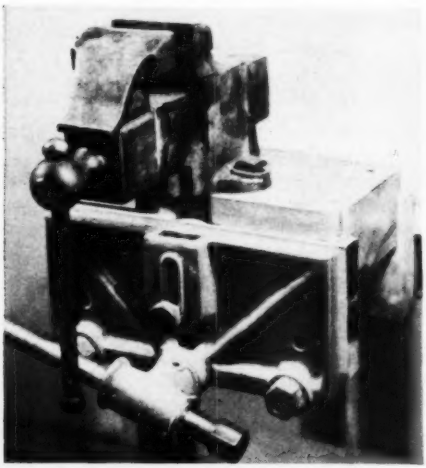


Triangular Sawhorse Sets Up Shop Anywhere You Want It

THIS triangular sawhorse can be taken apart quickly, stored flat, and carried to a job in one hand.

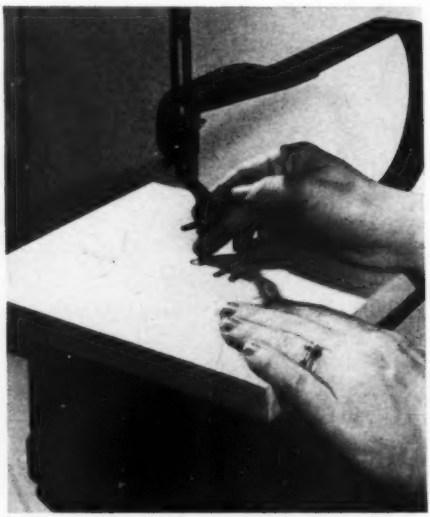
It is made by assembling three frames of 1″-by-3″ board 24″ long, as indicated in the photos. Attach two loose-pin hinges to each of the ends. You just pull out the pins to collapse the piece.

When it is set up in U shape with one corner open and a plank on top, you can use it as a scaffold or temporary workbench.—*R. G. Cooper, Trenton, Ontario.*



Two Vises Take Space of One

You can use a metal vise for occasional jobs without taking bench space. Bolt the vise to a T-shaped adapter, made by screwing two hardwood blocks together, and clamp in the woodworking vise. There is no need to remove the adapter for storing. My vise has a steadying lip, so I notched the adapter to take it.—*H. J. Gerber, Stillwater, Okla.*



New Life for Old Jigsaw Blade

BY RAISING the work up to the unused portion of a tooth-worn jigsaw blade, you can double its cutting life. Make a second table out of 1″ stock, drilling a center hole to admit the blade. Then screw it to the jigsaw table at the front and the back.

Men with mechanical skills:

measure yourself against this yardstick

Mechanics Creed

Upon my honor I swear that I shall hold in sacred trust the rights and privileges conferred upon me as a certified mechanic. Knowing full well that the safety and lives of others are dependent upon my skill and judgment, I shall never knowingly subject others to risks which I would not be willing to assume for myself, or for those dear to me.

In discharging this trust, I pledge myself never to undertake work or approve work which I believe to be beyond the limits of my knowledge; nor shall I allow any superior to persuade me to approve aircraft or equipment as airworthy against my better judgment; nor shall I permit my judgment to be influenced by money or other personal gain; nor shall I pass as airworthy aircraft or equipment about which I am in doubt, either as a result of direct inspection or uncertainty regarding the ability of others who have worked on it to accomplish their work satisfactorily.

I realize the grave responsibility which is mine as a certified mechanic, to exercise my judgment on the airworthiness of aircraft and equipment. I, therefore, pledge unyielding adherence to these precepts for the advancement of aviation and for the dignity of my vocation.

This challenging creed has made the U. S. Air Force the finest technical service in the world. If you are a man who feels a deep sense of satisfaction from the knowledge of a job well done, the U. S. Air Force offers you a rewarding and exciting life. Skills you acquire in the Air Force will help you choose and succeed in your future career.

YOU GO PLACES FASTER ON THE ALL VOLUNTEER TEAM

THE U. S. AIR FORCE

Paste Coupon on Postcard and mail to M-45-PS

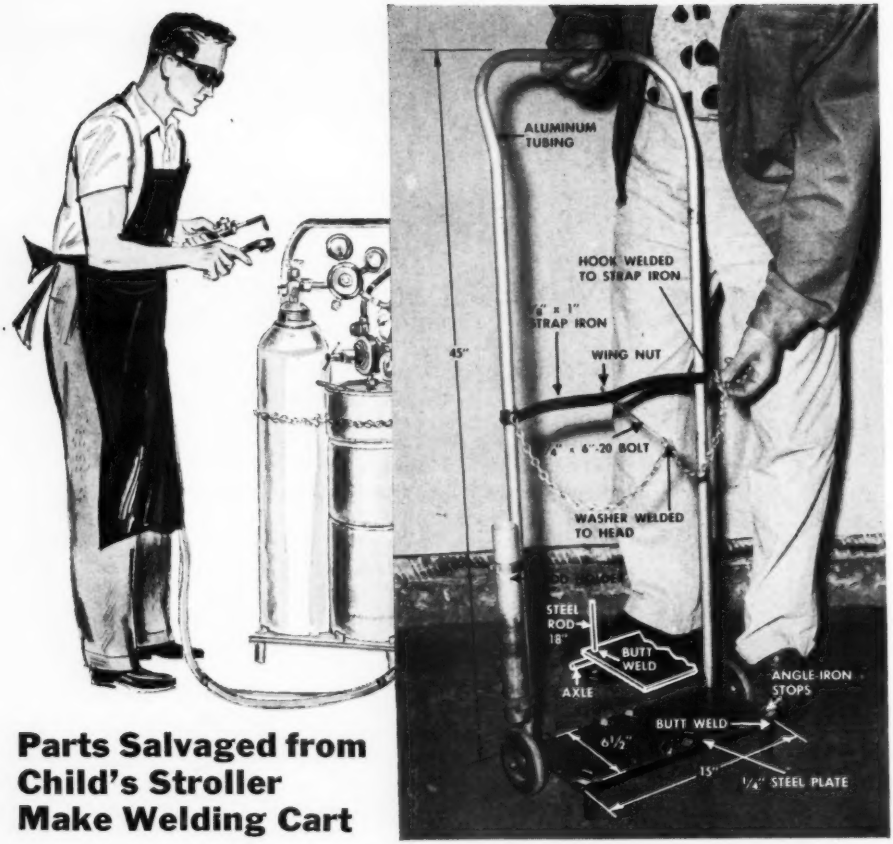
Airman Recruiting Information Branch
Box 2202
Wright-Patterson AFB, Ohio

Please send more information on my opportunities for enlisting in the U. S. Air Force. I am between the ages of 17-34 and reside in U. S. A. or possessions.

Name_____

Address_____ Age_____

City_____ Zone_____ State_____

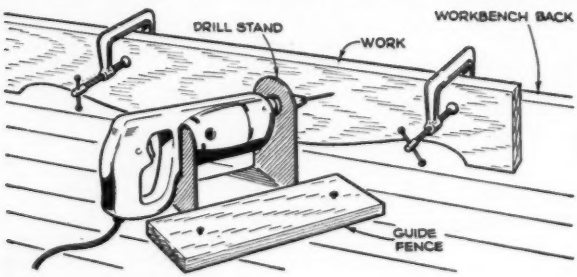


Parts Salvaged from Child's Stroller Make Welding Cart

THE handle, axle and wheels from a child's stroller helped in making a handy rig for my welding tanks. The aluminum-tubing handle was pushed over two steel rods that I welded to a base plate, to which I also fused the axle. If your stroller axle doesn't seem sturdy enough, use ⅜" steel rod. In fact, if an old stroller isn't available, you can bend a handle out of a length of tubing and use any pair of wheels.

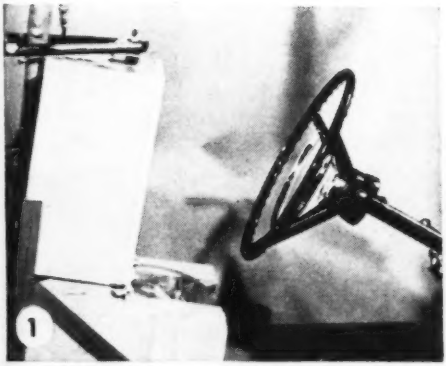
Bolt a harness to the handle and weld legs and angle-iron stops to the base. I keep welding rods in tubing strapped to the handle.—*M. C. Anderson, San Lorenzo, Calif.*

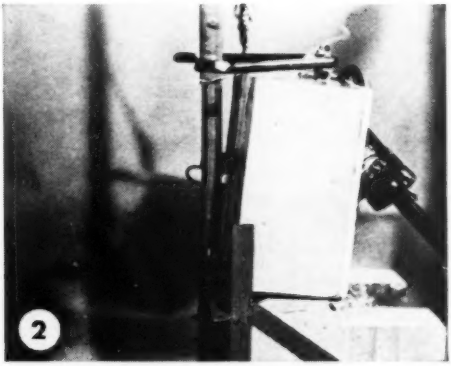
Simple Setup Enables You to Drill Holes at Any Desired Angle

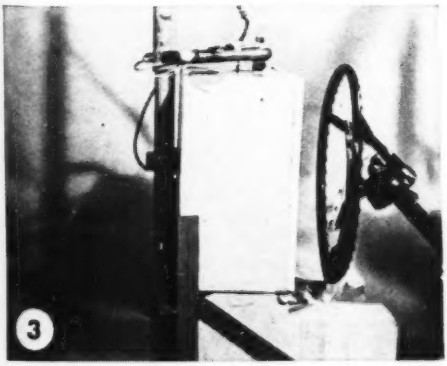


WITH a strip of wood as a guide for an electric drill resting on a stand, you can bore accurate angular or 90° holes in small stock. Clamp the work to the back of the bench. Then tack the guide at the desired angle to the bench top. Slide the unit along the guide.—*R. G. Cooper, Trenton, Ontario.*

After more than two years of testing and research, Ford comes up with an exclusive new contribution to driver safety!







1. Test equipment for impacting steering wheels is shown in illustration No. 1. A mass equal to the weight of the driver is dropped onto the wheel—in this case, Ford's exclusive Lifeguard deep-center design.

2. As block strikes deep-center Ford wheel, spokes yield under impact, absorbing energy as they do so. The force is dissipated before the block reaches steering post.

3. Note in illustration No. 3 the rim has not collapsed but rather the spokes have yielded following the *controlled* direction pattern that helps protect the driver from injury.

FORD MOTOR COMPANY

"—and furthermore, since Mad Man Jerk wants publicity in the newspapers for his Ninety-Day Wonder, I'm inviting the Capitol City *Times* to send a reporter and photographer to cover the story.

"Up to now I've been polite. I've never mentioned the name of the lot that sold me the lemon. But unless this Gus Wilson proves that the Ninety-Day Wonder isn't an A-1 lemon, I'm going to run the jerk who sold it to me out of business. If Wilson *can* fix it and prove to me that the car was all right when I bought it—are you listening, Red Plummer?—I'll give the owner of the lot free plugs for a full year!"

GUS snapped the radio off. In front of the shop there was a screech of rubber as a car pulled up. Johnny Carter came running in.

"Did you hear that!" he cried. "If you can't fix his car, we're both ruined!"

"But I think I can fix his car," Gus said quietly. "And furthermore, I think I can prove that his trouble was entirely of his own making."

"You can?"

"One of his sponsors is Bill's Auto Accessories. He plugs one of their gadgets every week." Gus smiled. "One in particular sticks in my mind. When I heard him advertise it I thought to myself that it made more sense than a lot of them." Gus stopped to get out his tobacco pouch. "But I had a notion at the time that this gadget might, under certain circumstances, cause just the kind of trouble that Gruntzman is having."

Stan said very patiently, "Gus, remember us? What trouble?"

"A short circuit," said Gus. He started to walk to Johnny Carter's car. "Come on, Johnny. You're going to drive me to Bill's Auto Accessories in Capitol City. We'll be back in plenty of time for the broadcast."

AT FOUR-THIRTY that afternoon, there was such a crowd in front of the Model Garage that Jerry Corcoran and two other state policemen were kept busy directing the parade of radio people, photographers, reporters and curiosity seekers.

Gus was the picture of confidence as the Ninety-Day Wonder sputtered up to him. Grunny Gruntzman got out briskly. He shook hands with Gus, not unpleasantly. Gus noted that, for all his dapper appearance and cocksure demeanor, he had a pleasant, rather sincere face. Gus got the distinct impression that Gruntzman honestly believed that he was crusading against the evils of the second-hand-car racket.

A man with earphones on made a signal to Gruntzman. The disc jockey took the microphone. He spoke briefly, outlining what was going on.

"And now," he concluded, "I'm going to turn the proceedings over to Gus Wilson of the Model Garage." Gruntzman handed the microphone to an announcer, who held it before Gus.

Gus said quietly, "Start the car." Stan Hicks jumped in and the motor turned over and then idled. The uneven rhythm was immediately evident. The announcer held the microphone close to it.

"And now," Gus said, as all eyes turned in his direction, "I am going to call upon my Ninety-Day Wonder expert to handle this problem." He looked into the crowd and his eye fell on four-year-old Molly Sturgess.

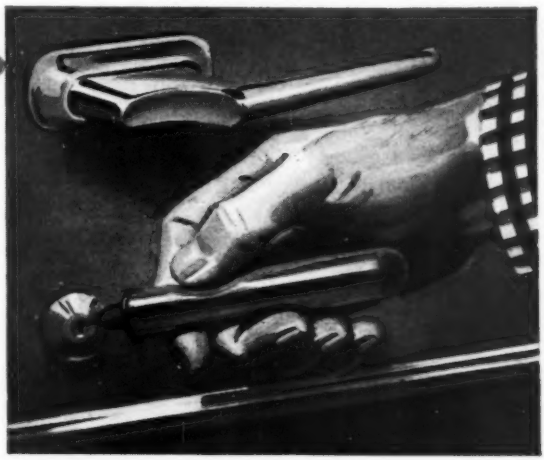
"Will you come over here, Molly?" he called. There was a stir in the crowd. Grunny Gruntzman's face began to get very red. Johnny Carter's eyes nearly popped from their sockets.

"TURN off the motor, Stan," directed Gus. "And then come out and lift the hood." While this was being done, observed, photographed and noted down, Gus bent down and whispered into Molly's ear. So interested was everybody in what was being done to the Ninety-Day Wonder that they didn't notice Gus's brief conference.

[*Continued on page 254*]

Texaco Tips On Car Care

How to prevent door locks from sticking



Occasionally, door locks on your car may tend to freeze up or stick, be difficult to open. Here's a simple way to keep them "easy to open." Squeeze powdered graphite in a tube directly into the keyholes. Also, in very cold weather, condensation inside lock may cause freezing—try heating your key lightly by match-flame, insert in lock and repeat if necessary to "soften" up jammed tumblers. Do not force key.

How to assure top engine power

On the road, you want the very best from your engine. Be sure to get it with *Advanced Custom-Made Havoline*—the motor oil that out-performs all others, regardless of price! Tested against the toughest motor oil competition on the market, *Havoline* proved its superiority. *Havoline-lubricated* engines delivered full power, used less gasoline and oil, stayed far cleaner. For top power and protection, change now to *Havoline*. See your Texaco Dealer, *the best friend your car has ever had.*

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THE TEXAS COMPANY

TUNE IN: TEXACO STAR THEATER starring JIMMY DURANTE, on TV Saturday nights, NBC. Metropolitan Opera radio broadcasts Saturday afternoons, ABC. See newspaper for time and station.

"Now," said Gus, "if you people will step back from the engine, my little expert will go to work." Molly climbed quickly up on the front bumper, leaned over under the hood, busied herself for a brief moment with her two little hands, withdrew her head and ran back to Gus. It was done so quickly that even the announcer didn't get over to see it.

"Start the engine again," Gus said.

This time the motor sounded smooth, even, regular. A burst of spontaneous applause went up from the crowd. The announcer rushed up to Molly.

"What did you do, honey?"

Gus interposed. "Trade secret," he said. "Isn't it, Molly?"

"Yes, Uncle Gus."

At this point Grunny Gruntzman proved himself not only a good sport but a good showman as well. He grabbed the microphone from the announcer.

"Folks," he said, "that gnawing sound you hear is your old friend Grunny Gruntzman eating his words. I guess I owe a year's free plugs to a certain second-hand-car dealer and I might as well give him the first one right now. Come over here, Johnny. Guys and chicks, I want you to meet an honest dealer. His name is Johnny Carter. And if I have anything to say about it, he'll be manager and owner of a new car agency in Capitol City before long. Johnny, I'm sorry for all the trouble I've caused you."

Johnny's face was red. He muttered awkwardly, "It's okay, Grunny. Thanks a lot."

GRUNTZMAN beckoned to Gus. "Folks, I want to introduce the proprietor of the Model Garage. Gus, tell us now, what did you—I mean your expert—do?"

"You've been a good sport, Mr. Gruntzman," Gus said, "so I'll be one, too. When you got your car winterized, Johnny Carter tied a card with a piece of wire to your radiator hose. The card told how much antifreeze you had. After he had done that, and *before you left his shop,* you had one of his mechanics install a metal support to the underside of the radiator hose. It was a gadget known as a Hosupport."

"That's right. But I don't see—"

"You undid the wire on the card so that the Hosupport could be installed, and then you tied it back on. Right?"

"Yes, but—"

"That's when your troubles began. Shortly after you started your engine, the fan blew the card and wire back until they were right beside the generator. The fluttering of the card caused the wire to come in contact with the generator. Being attached to the metal Hosupport, it caused a constant short circuit.

"All my expert did was to take off the card and the wire."

One of the radio engineers was making signals to Gruntzman. The disc jockey nodded. "Guys and chicks, this concludes the Grunny Gruntzman show for today. I hope some of you will have learned as good a lesson as old Grunny has. Don't jump to conclusions. So long!"

THE radio men began gathering up their equipment. The crowd drifted away. Gruntzman was talking with Johnny Carter about the free plugs he was going to give him. Suddenly the Ninety-Day Wonder began to choke and sputter, and then it died altogether. Stan Hicks looked at Gus. Gus looked at Gruntzman. Gruntzman, his face becoming crimson with anger, looked at Johnny Carter.

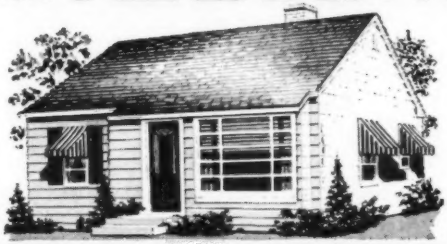
"For crying out loud! There it goes again! I've been swindled again! I—"

"Hold on, Gruntzman," Gus said sternly. "Remember your advice to your listeners. Don't jump to conclusions. I suggest that you look at your gasoline gauge."

The disc jockey did so. He looked up, his face sheepish. "I'll be darned," he said. "Out of gas. Which," he added, "just about describes me!" END

NEXT MONTH: Gus drives a bad bargain.

This ALADDIN Readi-Cut House



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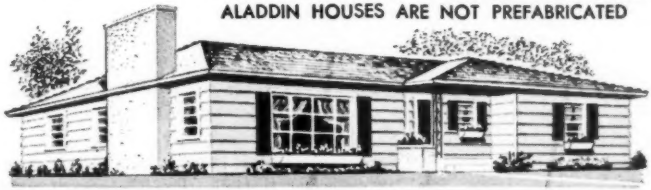

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"Black Box" Points Way to Oil and Gold

[Continued from page 119]

gions are finding, conversely, that uranium can serve as a "tracer" to lead them to the yellow metal. A higher-than-normal reading of radioactivity on the scintillation counter, in this case, tells them where to dig.

In this way a group of prospectors, exploring radioactive "hot spots" in the black sands of French Guiana, recently located thousands of dollars' worth of gold. During a visit to New York they gratefully reported their success to M. M. Reiss, former Atomic Energy Commission physicist and president of The Radiac Company, which supplies scintillation counters and other tracer-prospecting and atomic equipment.

Not long ago the Radiac people received an order for a scintillation counter by long-distance phone, from the mayor of a large Florida city. With its aid, he was going to explore his property for thorium, which like uranium can be detected by its radioactivity. He didn't find enough thorium to be worth exploiting. But he did find substantial quantities of valuable titanium, often found together with thorium, and his ore is now being actively mined.

Similarly, the radioactivity of uranium has led hunters with scintillation counters to important associated deposits of silver, tin, vanadium, nickel and bismuth.

The most striking success of tracer prospecting, in this country, has been as an aid to searchers for oil. When a subterranean oil formation lies beneath terrain explored with a scintillation counter or supersensitive Geiger counter, the instrument usually reveals a peculiar and characteristic pattern of radioactivity.

Directly over a hidden oil pool the instrument registers abnormally low radioactivity. But at the border of the oil formation the needle climbs to show higher radioactivity than normal.

Above an oil formation of the kind geologists call a closed dome, the high-level border, or "halo," is circular or elliptical, encircling the area of low radioactivity. Carry a counter by car or afoot squarely across the formation, while a recording attachment continuously charts its readings, and the graph looks like a cross section of a volcanic crater. The raised rim corresponds to the radioactive halo. The central depression —of low-level radioactivity—marks the most likely spot to drill for oil.

Elsewhere the bordering halo may take the form of an extended pair of wavy lines, with a low-reading area between them. Typically this indicates a buried stream bed that is filled with oil or gas.

Of course, oil formations are not invariably signposted in such ideally clear-cut fashion. Various geological compli-

The man who shoulders his responsibilities has no room left for a chip.
—THE SIDEWALK SUPERINTENDENT

cations can alter and partially mask these simple radioactive patterns. But when readings of radioactivity are taken systematically at measured intervals, usually the pattern "shines through."

Properly the counter's verdict does not replace, but supplements and confirms, other signs of oil familiar to trained geologists. Even so, experts are apt to feel as if they had been looking for oil blindfolded, when they first see the "scint" in action.

Practical-minded prospectors, taking advantage of this scientific divining rod, are hastening to cash in on the new technique.

Helicopters skim the ground at 300 to 500 feet, taking scintillation-counter readings to map radioactive abnormalities. Four-wheel-drive trucks make spaced runs at 10 m.p.h., bearing instruments that record surface radioactivity continuously on moving tape, driven by the speedometer cable. And the charts that result are enabling the surveyors to tap new wealth in mineral treasure. END

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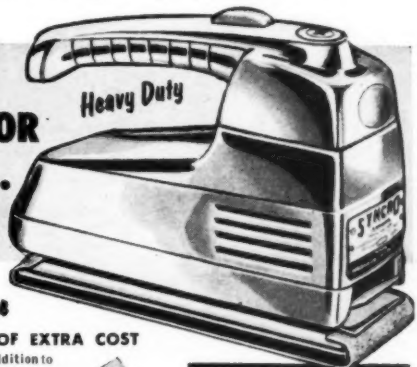

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DO THIS: (1) Send coupon, your tool dealer name, address—we'll ship No. 900 Sander, Sanding Handbook, Sandpapers to you. (2) Pay postman $20 (10 days rental fee), COD fee, postage charge, on arrival. (3) Use sander 10 days, return it prepaid—we'll refund your $20 promptly. (4) To buy it, pay dealer (named on coupon) balance of $19.95. Send us *receipt of purchase* from dealer, we'll ship you $3 worth of sandpapers as our Gift! (OFFER ENDS JULY 1, 1956.)

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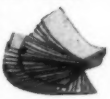

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SAWS AND SANDERS

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roomful of mathematicians busy for a week. That means that if your engine behaves in ways you haven't anticipated, you can change your testing pattern at once. Simultaneously, to keep the boys back at the home factory happy, the obliging machine will send them a teletyped copy of its findings.

Next door to the four-cell Engine Test Facility, scale models of experimental missile designs are beginning to be put through what AEDC calls its Gas Dynamics Facility. The hypersonic tunnels used here are comparatively small. They have to be, because wind velocities of from four to 10 times the speed of sound call for fantastic quantities of air, even in a model-testing cell.

Steel bottles. To feed the Gas Dynamics Facility's most spectacular units—two 7,600-mile-per-hour tunnels that are not yet finished—air at a pressure of 4,000 pounds to the square inch will be stored in a steel bottle nearly four city blocks long, four feet in diameter, and weighing one ton to the running foot. Not far away, exhausters will bleed the air from a steel sphere as high as a seven-story office building.

Between the two steel tanks, a model of the missile to be tested will be set up facing an hourglass-shaped nozzle whose waist is only 1/16 of an inch wide at its top velocity setting.

When dispatchers open the valves between the two tanks, the midget rocket will be in for 15 minutes of the world's fastest simulated flight.

The big wind. In addition to the Engine Test and Gas Dynamics plants, there's a third showpiece at AEDC—a "Gee Whiz" item that they save for us visiting firemen until last.

That's the Center's huge Propulsion Wind Tunnel: two still-to-be-completed rectangles of pipe spread over 600 acres. Their ducting reaches the incredible diameter of 60 feet at the testing zones.

One rectangle will be used to set up transonic velocities for full-size rockets, and for jet engines nested in their fuselages. The other will take the same sort of equipment and give it a 2,500-mile-per-hour supersonic treatment.

To set up this flow of air, 300 freight-car loads of motor and compressor parts were hauled into Tullahoma last year. They are not all assembled yet. But when they are, they will form the world's biggest single rotating machine, nearly as long as two football fields.

At one end, the two most powerful electric motors ever built, 83,000-horsepower versions of the little synchronous jobs found in electric clocks, will be kicked over and brought up to speed by a pair of 25,000-horsepower starter motors. It will take eight minutes for this formidable power train to reach its 600-r.p.m. operating speed. When it does, its four motors will use more juice than a city the size of Nashville.

The most important mistakes to correct are those that you feel sure you can get away with.
—THE SIDEWALK SUPERINTENDENT

Cooling them off. At the other end of the shafting, a battery of air compressors weighing 7,000 tons, or as much as an antiaircraft cruiser, will soak up the 216,000 horsepower. Approximately 100,000 gallons of cooling water a minute, pumped from a 5,000-acre reservoir, will carry away the heat that these compressors generate.

If for some reason the main power lines at AEDC should ever go down, making it impossible to stop the huge rotating parts with electric braking, built-up momentum would keep it running for 50 minutes. During that time, with the water pumps shut off, much of the equipment would be burned to a crisp. But it will never happen. The Center's stand-by generators would cut in instantly. And with the driving motors converted into the world's biggest power brakes, the monster machine would be brought to a safe stop in three minutes. END

Wanted: Marinas for 4,000,000 Boats

[Continued from page 127]

water storage checks fouling and keeps boats from sinking in storms.

A problem at John Kerr Lake, N. C., was solved by a marina owner in an ingenious way. President Sam Pease of the Tar Heel Marina wanted to give his customers shelter from sudden squalls. He also wanted to open a snack bar right down at the waterfront.

He accomplished both by designing something new: a breezeway dock. At one end he built a shop where he rents water skis and motors. At the other end he built his snack bar. Between these is a seagoing breezeway where people huddle during storms.

So today's marinas are a lot more than just boat "filling stations" or old-fashioned boatyards. They rent motors, boats, surfboards. They will even rent you a boat and driver to tow you on skis. The Tar Heel Marina rents fishpoles for 50 cents. You can get laundry service, a shower, ice to keep your fish. In many marinas you pay from $2 to $15 a month for boat parking.

Good marinas make money. Bill Walker, in Virginia, started with about $7,000 that he and his wife had saved. Today, six years later, he's worth $60,000. Another marina owner told me that he expected to sell 60 boats and 60 motors this year for a gross profit of $16,000.

A man is as old as he feels on a beautiful weekend.

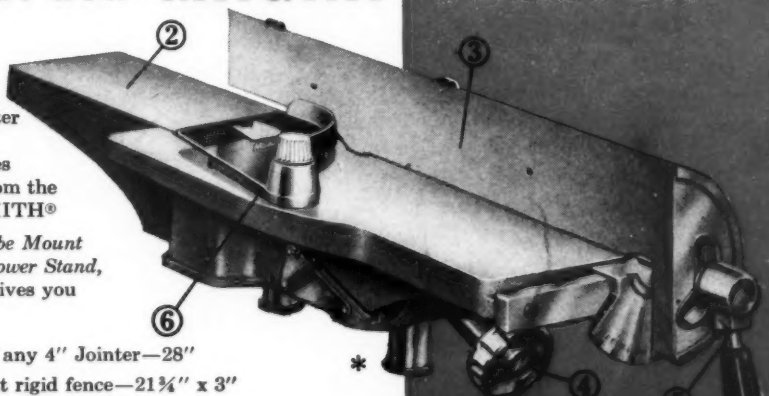
—THE SIDEWALK SUPERINTENDENT

But new marina gimmicks are coming fast. Some are opening "boatels."

At John Kerr Lake, Sam Pease has another idea: he's putting in ship-to-shore radio. Now you can phone the marina from your outboard boat and say:

"Tell my wife the fish are biting and I won't be home until tomorrow!" END

Here's that new MAGNA JOINTER



This big Magna Jointer has all the built-in precision and features that you'd expect from the makers of SHOPSMITH®

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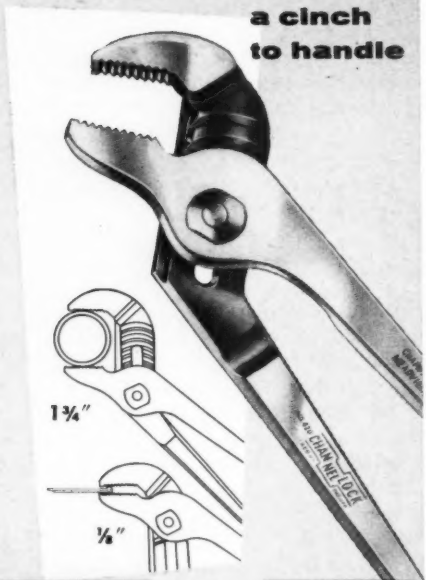
grips like a pipe wrench

a cinch to handle



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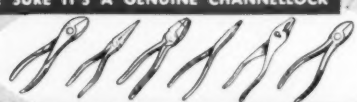

CHAMPION DeARMENT TOOL Co. MEADVILLE, PA.

Corvette Challenges Thunderbird, Hawk

[Continued from page 139]

Ford slide-rule virtuosi were thinking about Chevrolet when they gave the Thunderbird a quick going-over for 1956. Starting with a car that was, in its field, selling like ladders in a burning building, Ford left the styling alone except for some minor matters: A Continental-type spare-wheel carrier rides the back now, and window wings and ventilators in the body have improved the cockpit cooling.

T-bird's new view. You can also have nice round Queen Mary type portholes in your hardtop if you like. It's a free option, although it costs Ford about $27.

All of Ford's safety equipment is available, of course. The new upholstery is firmer and you can now put a passenger in the middle of the seat over the tunnel without risk of being sued for cruel and inhuman treatment.

As before, there's a three-way engine-and-transmission choice. With the standard transmission, you get the 292-inch engine, running at 8.4:1 and delivering 202 horsepower at 4,600 r.p.m. With overdrive, 312 inches, same compression ratio, 215 horses. Fordomatic, 312, 9:1, 225 hp. For comparison, last year's Fordomatic delivered 198 horsepower out of the 292-inch engine.

In five or six miles of dusk-time motoring around the streets of Dearborn, during which, if anyone is listening, we did not do 81 miles per hour, the Thunderbird seemed to this reporter to be slightly more taut and firm than last year's. It has more of an all-in-one-piece feeling, and I believed the man who told me that the chassis is slightly heavier now. Other than that, it handles like the '55, which is to say that it handles well. The front suspension is unchanged, the rear springs are some three inches longer and the shocks have been recalibrated to put up a bit more fight. They've gone and raised the steering ratio from 20 to 23 to 1, however. Customer demand, the man said. (Chevrolet buyers must have quicker reflexes, because the Corvette is a snappy 16 to 1.)

[Continued on page 264]

Exclusive Orbital Action!
Blade moves ahead on upward cutting stroke—moves back 3/64" on downward relief stroke. No harmful "drag"—blades run cooler, last far longer—cutting speeds increase up to 4 times!

New! Just $99.50!

World's only orbital-action bayonet saw!

Now—the first *real* improvement since portable jig saws were invented! It's Porter-Cable's revolutionary new Model 148—designed around a wholly new principle, *guaranteed to outperform any other portable jig saw at any price.*

Orbital action makes the difference. Blade teeth are in contact *only* on the cutting stroke—*back away* on the relief stroke. Harmful "drag" is completely gone—and performance reaches a new high.

By actual test, the Model 148 cuts up to 4 times faster than the best conventional up-and-down saws. It has a full 2" capacity in wood—¾" in aluminum, ¼" in steel. Its cool, comfortable grip and perfect balance make easy work of any job. Get the whole amazing story from your Porter-Cable dealer—or write today for full information and name of your nearest Dealer.

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belt sanders • finishing sanders
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In Canada, write Porter-Cable, Ltd., Box 5019, London, Ont. Canadian prices slightly higher.

Corvette Challenges Thunderbird, Hawk

[Continued from page 262]

Getaway. You don't need a dynamometer to notice the presence of the extra 27 horses, and the '55's 0-60 time of 11.1 seconds should be down a peg or two and everything else with it. The T-bird and the Corvette should run closer together than half-past six, the Corvette in front by a thick whisker. Still, they may both get a good look at the squared-off tail of the new Golden Hawk Studebaker when it comes to take-off.

The Hawk is a blue chip going down on Studebaker's bet that there are customers waiting for a sports car, or a sports-type car, that will carry more than two people. The Golden Hawk is a full five-passenger sedan. Power plant is the big (352 inches) Packard engine, putting out 275 horsepower and 380-foot-pounds of torque at 2,800 r.p.m. The Hawk has the highest power-to-weight ratio of all U.S. production cars, and the factory frankly states that it was designed to run away from everything else in the country. Will it? Probably. It does 0-30 in 3.9 seconds, 30-60 in 5.4, and 0-75 in 15.1. If that isn't quick enough for you, you must own more life insurance than I do.

This is a small car—17 feet long, six wide, a couple inches under five feet high—and it looks a good deal more like the '55 Speedster than does the rest of the South Bend line, which is conventional and big. Incidentally, Raymond Loewy says that he designed it, and Studebaker-Packard says that he didn't, that William Schmidt did. Whoever did, it's a good-looking automobile.

Eyebrows, wings, fins. The grille is all new, a squared-off, Ferrari-like, cookie-cutter type, flanked by a pair of typically Studebaker eyebrow-shaped air intakes. There's an air-scoop bulge on the engine lid but it's a dummy. A couple of pretty big parking-and-signal lamps sit high on the front wings, effectively lousing up a nice line, and the rear wings

[Continued on page 266]

IT SMELLS GRAND

SNIFF IT! YOU'LL SAY "THAT'S FOR ME!"

IT PACKS RIGHT

CUT TO PACK IDEALLY!

IT SMOKES SWEET

JOY YOU'VE DREAMED OF — YOU'LL AGREE!

IT CAN'T BITE!

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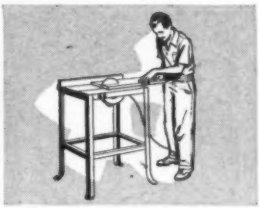

Convert SKIL to a tilting arbor table saw with optional SKIL table. $39.95

Make cabinets, cupboards, closets, an easy weekend project with SKIL Saw!

Extra rooms, extra storage space are easy to build with SKIL Saw!

There's a real thrill in finishing those big jobs you've dreamed of doing. There's an extra satisfaction that comes with the family's pride in your ability. Many projects you could never handle before are *easy* with SKIL Saw to help you!

This speedy, powerful 6" SKIL Saw has all the features professional builders demand for peak performance and efficiency. So simple and safe to operate, a boy can handle it. You'll do all kinds of home workshop jobs—from simple furniture-making to construction of a garage or porch!

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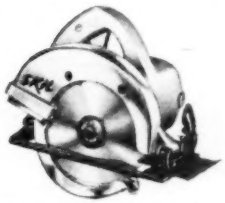

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Cuts through plywood, sheeting, siding, even stone and metals! Lightweight and easy to handle. Built-in bevel and depth adjustment for accurate cutting. Automatic blade guard and trigger-type switch for safety. Powerful motor; sturdy die-cast aluminum housing.

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I enclose 10¢. Please send me SKIL Chart 105, a step-by-step guide that tells how to modernize my kitchen by making built-in cabinets.

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BLOCK, STRIP OR RANCH PLANK – Now it's easy and economical to give your home the new beauty of modern oak floors . . . with all the glamour of nationally-famous Bruce Prefinished Hardwood! In only a few hours, your living room, bedroom, dining room—or that unfinished room upstairs—will glow with a style as modern as tomorrow. You can choose Block, Strip or Ranch Plank design.

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BRUCE

Bruce Hardwood Floors

Product world's largest hardwood flooring maker

Corvette Challenges Thunderbird, Hawk

[Continued from page 264]

have the fin-type bulges that are getting to be as standard as four wheels on U.S. automobiles.

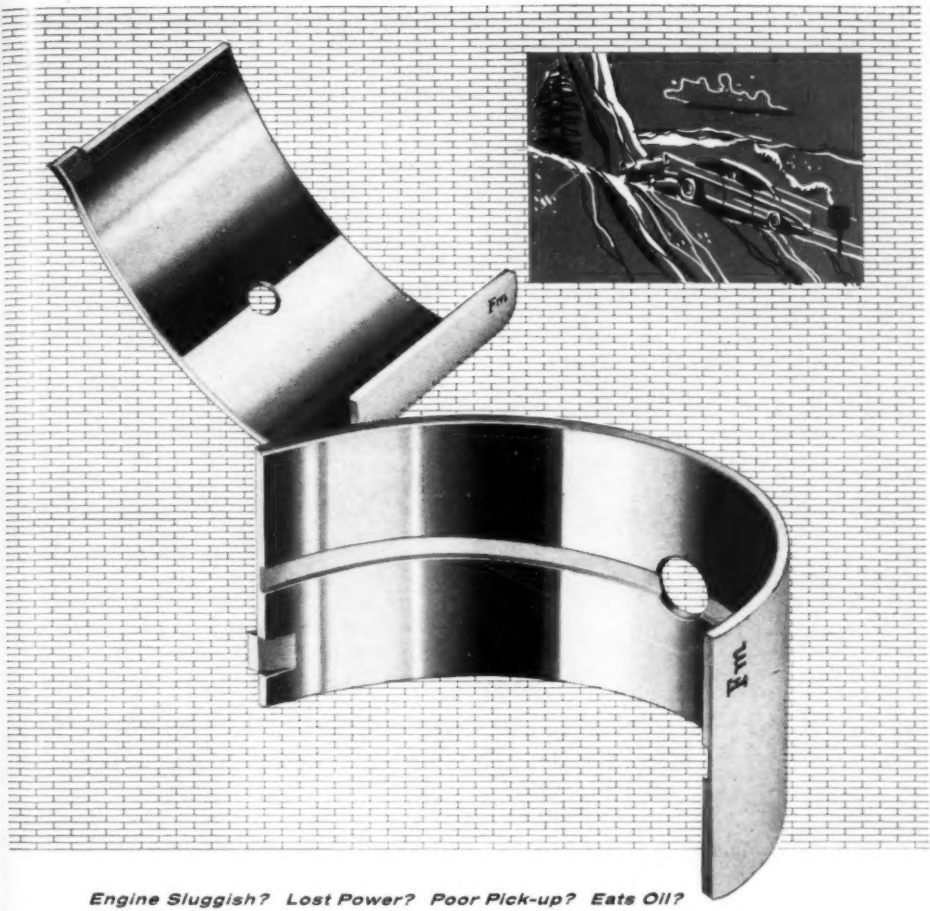
The nicest instrument panel available on an American car today is the Golden Hawk's—round, white-on-black instruments set in a machine-turned metal facing and all eight of them clearly visible through the T-spoked steering wheel, the speedometer, vacuum gauge and tachometer most prominent.

Hawk flies low. Only a prototype was available for driving in South Bend when I was at the proving grounds a couple of weeks before the Hawk was released, and it was a bit heavier than the standard 3,440 pounds. Manual shift with overdrive is regular equipment, but this car had the optional dual-range Ultramatic, an inoperative tachometer and signs of a lot of use. Therefore the acceleration figures I obtained—on a fifth-wheel speedometer—are impressive.

This is a fast automobile by any standard in the world. It needs big brakes, and has them: 195 inches of brake area in finned drums, 11 inches in front, 10 in the rear. Safety door latches are standard equipment, seat belts and dash padding optional.

Solid and sure-footed. Suspension is Studebaker standard. It feels slightly stiffer than normal. The Golden Hawk is a solid, sure-footed car, a pleasure to handle. Even in an absurdly tight corner it showed no lethal tendencies, no rear-end determination to leave the county, no more roll than it was entitled to. With only the driver aboard, it felt nose-heavy to this observer, but with the family in the back seat and three or four sacks of uranium ore in the trunk it would be as on the level as a church fair.

For $2,850 bare at the factory or $3,673.82 with every extra in the catalogue, including wire wheels, this is quite a buy, indeed. The Golden Hawk is the best answer available for the character whose wife won't allow a sports car in the family garage because it has no room for the kids. END



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Smooth Engine Power calls for Quality Bearings . . .

FEDERAL-MOGUL QUALITY!

Engine performance starts at the connecting rod and crankshaft bearings. These are the vital points where gasoline explosive force is converted to turning power. Bearings take the impact, carry the load of variable driving conditions. They meter oil and control the flow of lubrication for cylinder walls and rings. Replacing with Federal-Mogul QUALITY bearings restores lively traffic response, smooth power on highways and hills, gas and oil economy, freedom from power-stealing oil pumping!

Ask your mechanic!

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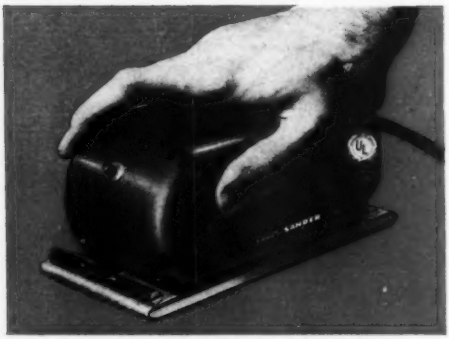

TAKE THE "IRK" OUT OF WORK . . .

clean up scores of sanding, polishing and finishing jobs *fast*—with professional results

WELLER POWER SANDER

Try your hand with this premium power sander. It's the most useful addition you can make to practical tools that get your work done faster and with results you'll be proud of.

The comfortable, compact design fits snugly in your hand. It responds perfectly to precision work, and it is practically impossible to stall.

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COMPLETE WITH ASSORTED SANDING PAPER AND POLISHING CLOTH . . $14.95

Ask your Hardware Dealer for a demonstration or write direct for literature.

Weller **ELECTRIC CORP.**
806 Packer Street
Easton, Penna.

[*Continued from page 104*]

they would blow away in a few days. Now, even an expert studying a finished house may find it difficult to tell if it was factory made or built conventionally.

Bowing to the public, many manufacturers never use that word "prefabricated." Instead, they say that their houses are "pre-cut," "pre-engineered," or "produced on the assembly line."

There are flaws in prefabs which have not wholly disappeared yet. The small models are usually designed for slab construction and sometimes are difficult to get with basements. Household storage space is limited in some models.

Money is like knowledge—the more you have of it the less you need to talk.
—THE SIDEWALK SUPERINTENDENT

Inside walls are not overly sturdy in some of these homes. Factory-assembled walls are often just two-by-twos covered with ⅜" gypsum board, as compared with the two-by-four framing and half-inch gypsum that are generally used by conventional builders. A wall that gets the shakes whenever you slam a door can become quite annoying.

Prefab prices vary from city to city. A model that is low-priced in one place may be over-priced elsewhere.

The house package that is shipped from the factory usually costs only about 40 percent of the price the buyer pays. The other 60 percent of the purchase price covers work done at the site and marketing costs. Since labor costs and the efficiency of local builders vary so much in different places, it is impossible for a manufacturer to tell you quickly exactly how much one of his houses will cost when it is erected on your site. A shopper must find that out by discussing prices with his local dealer.

The prefabbers, nevertheless, are moving ahead. They already have about 15 percent of the market. In a few years they expect to be producing most of the new homes built. END

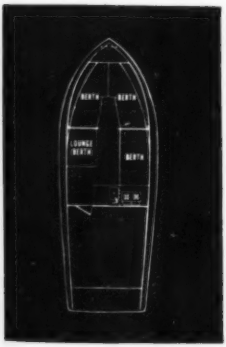
As little as $53* (full price!) buys a 1956 CHRIS-CRAFT Boat Kit!

SPORTS UTILITIES $53 to $255

Enjoy new fun and adventure, save up to 50% with a 1956 Chris-Craft Boat Kit! Choose from such top performers as the *8-ft. pram (kit $53); the sporty 12-ft. Vagabond (kit $133); the trim 14-ft. Dolphin (kit $158); the rakish 14-ft. Caribbean (shown at left; kit $192); or the rugged 15-ft. Marlin (kit $255).

SPORTS RUNABOUTS $167 to $349

Finest designs and materials go into our new Boat Kits; they're *easy* and *fun* to put together! See the sleek, five-passenger 14-ft. Bonito with smart center deck (kit $167); the sensational 14-ft. Barracuda (kit $229); or the superb 16-ft. Custom Runabout (shown at right) with its roomy cockpit (kit $349).



CRUISERS Outboard or Inboard $352 to $910.50

For weekend or vacation cruising, there are low-cost cruisers: the 16-ft. Outboard Two-Sleeper Express (kit $352), and both inboard and outboard models in the beautiful 22-ft. Four-Sleeper Express Cruiser shown above (hull and cabin kit only $910.50; cabin interior kit $83; fly-bridge windshield kit $62.50).

Prices f.o.b. factory, subject to change without notice.

BUY NOW! SEE YOUR CHRIS-CRAFT BOAT KIT DEALER OR MAIL COUPON, TODAY!

CHRIS-CRAFT CORPORATION, BOAT KIT DIVISION, ALGONAC, MICHIGAN

Gentlemen: Please send me more information about 1956 Chris-Craft Boat Kits.

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Make your whole home up to 15° cooler this summer! Cut your fuel bills up to 25% next winter!

You've dreamed about insulating your attic . . . talked about doing it . . . known so well how much warmer it would make your home in winter . . . how much cheaper to heat . . . how much cooler and more "sleepable" in summer.

But perhaps you *didn't* know that you now can TWINSULATE your whole attic in just a few hours this very week end . . . with Gold Bond TWINSULATION®.

TWIN ACTION... Gold Bond TWINSULATION gives you heat-blocking, fireproof rock wool *plus* a heat-reflecting covering of silvery aluminum *all* around it. You get a unique *twin insulating action* that cuts your fuel bills up to 25% and makes your house ever so much more livable all year!

See your Gold Bond dealer now. He'll show you samples, give you all the simple directions you need and supply a handy stapler for *easy* application.

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Send for booklet that tells all about Gold Bond TWINSULATION . . . what it does for your home, how it cuts fuel bills.

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Dept. PS26, Buffalo 2, N. Y.

I enclose 10¢ for "Home Insulation" booklet.

*Name*_____

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*City*_____ *Zone*___ *County*____ *State*____

Mr. Power Steering's Ship Comes In

[*Continued from page 164*]

big advantage. Now, the inventor figured, he'd sit tight and wait out the boom.

By the late forties sales had slackened and customers had begun to pick and choose. The big companies had to look for new selling points. The log jam broke in 1951 when, with great fanfare, one of them announced a model with an absolutely new feature—power steering. It was hot—it was revolutionary . . .

Ironically, the first production of power-steered cars didn't net Davis a nickel. They used Davis principles, but only those in the expired patents.

The inventor didn't worry. Within hours of the announcement, Bendix was besieged with customers for its Davis-licensed units. Adaptation and tooling problems that had dragged on for years were conquered in weeks as the big companies rushed to meet the competition.

> ***A badly needed invention in America today is some kind of dough that really sticks to your fingers.***
>
> —THE SIDEWALK SUPERINTENDENT

Davis draws royalties today primarily from his axial-movement patent, which will expire in three years. But he isn't waiting. Over the years he has taken out over 30 U.S. and foreign patents in this field. And he has further improvements on the fire. With these he hopes to maintain the dominant position of Davis-licensed power-steering units for years to come.

About once a week, a struggling inventor drops in at Davis' modest Waltham office, eager to show him bundles of blueprints. Davis courteously looks them over. But he warns his visitors that a good idea is only the first step toward a commercially successful invention. The real headaches come with investigations, designs, tests, patents. Timeliness is vital; so is luck. And, he adds with only a touch of grimness, don't overlook the other requisite for becoming a successful inventor: a long life. END

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10-INCH DELUXE
TILT-ARBOR SAW
(Table extensions and stand optional. 8-inch models available.)

Now! Professional quality in home power tools!

What a pleasure to work with — the new Toro power tools! Mirror-polished working surfaces make handling easy. Every operation is done accurately. And every finished piece fits tightly, solidly, to give you the kind of results you never thought possible with home workshop power tools.

The reason is simple. Toro has built *professional* quality into its home workshop table saws, drill press, jointer-planers, jig saw, band saw and belt sander. Castings are heavier. Finishing is finer. Tolerances are closer.

And no wonder! Toro power tools are backed by 40 years' experience in building precision power equipment — including the world's most complete line of power mowers.

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It's A *Good* Rule

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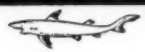
Easy to use 8′ tape rule– Model 1208W $1.19 at your hardware store.

Other Stanley Rules from 75¢ up, 6 ft. to 12 ft., and each in the reuseable plastic box with the magnifying lens. You'll use the rule — you'll use the box.

Write Stanley Tools, 2502 Elm St., New Britain, Conn., for *free* booklet on measuring tools and how to use them.

STANLEY

Shark Brand Swedish Chisels



Make Your job easier.

You'll do neater, more accurate woodworking with SHARK BRAND SWEDISH CHARCOAL STEEL paring chisels . . . hold their sharpness 3 times longer than ordinary chisels.

Write for new folder Dept. PS

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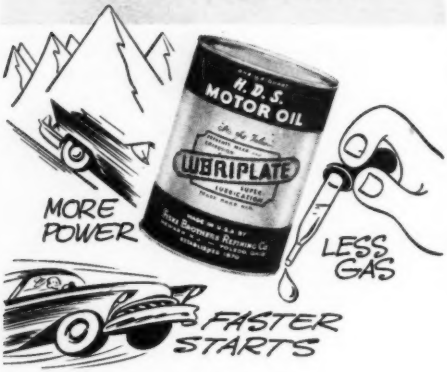
THE MODERN LUBRICANT



LUBRIPLATE H. D. S. Motor Oil—A heavy duty superior oil with high film strength. Fully detergent, keeps your engine clean, gives your car more power, faster starts, better fuel economy. *The oil that requires no additives.*

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LUBRIPLATE Car Lubrication is different . . . it's better. LUBRIPLATE Lubricants make your car run better, last longer. Protect your car investment, cut your repair bills and parts replacements to an absolute minimum. If you want the very best for your car insist on LUBRIPLATE Lubrication.

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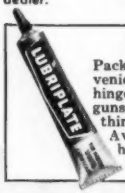

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Fuel Injection Is Coming This Year

[*Continued from page 143*]

it is torque that supplies the push at the rear wheels.

Cheaper fuel, more miles. With fuel injection, a car owner can, if he likes, trade the added horsepower that he gets for cheaper fuel. A fuel injection engine will perform nicely, without pinging, on lower-octane gas. Or he can trade the horsepower for even more miles per gallon by leaning-out his mixture.

With fuel injection, hood lines can come down because the carburetor is thrown out. The fuel-distributing system, and even the air cleaner, can be located anywhere in the engine compartment.

If fuel injection is so wonderful, why has it been so long in coming? The answer is that it has always been too expensive for Detroit to consider. The injection system alone on the Mercedes-Benz, best known of the fuel-injection cars, costs $500.

A carburetor is simple—at least in theory. A fuel-injection system, with fuel pumps, fuel filter, injection nozzles and other components, is not. For years Detroit looked at fuel injection and said uh-uh.

In the absence of a demand, little was spent to explore fuel injection's possibilities. Some racing and aircraft engines used it because cost was a minor factor. Diesels used it because injection was the heart of the system.

But so long as a carburetor cost three dollars, nobody was interested.

Power and pots. Then came the flood of high-horsepower V-8s. Their fuel and air appetites were finicky. The old two-barrel carburetor that the automobile companies bought for three bucks gave way to one with four barrels that cost $12 to $15. When, as sometimes happened, two of the things were mounted on an engine, the cost soared to as much as $30. Fuel injection then began to look better.

Detroit now has been working actively on fuel injection for at least 2½ years. Bosch was successful at getting the pros-

[*Continued on page 274*]

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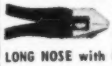

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5½ inch....$ .89
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DIAGONAL SIDE CUTTER PLIERS

5 inch.....$1.09
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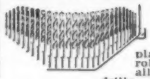
(Add 10c to each plier for postage and handling.)

CHROME VANADIUM 29 Pc. DRILL SET



Specially made for speed drilling. Instudy plastic tool roll. Finest alloy steel drills hardened and precision ground to the sharpest, longest lasting cutting edge obtainable; will easily and cleanly bite through hardwoods, plastics, aluminum, iron and the toughest steels. Unconditionally guaranteed for thousands of drillings. Full jobber length. Sizes by 64th from 1/16 to ½". **NOW** $6.49 ppd.

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60 Pc. Set Wire Gauge CHROME VANADIUM DRILLS

Top quality high test Chrome Vanadium Drills designed for speed drilling through toughest steels, woods, plastic, iron and aluminum. Precision ground, long-lasting cutting edges. Guaranteed to give years of satisfaction. A full 60 pc. set nos. 1 through 60.

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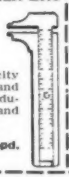

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Saw shoe slips flush into table in seconds.

Same cutting capacity as 8-in. Table Saw.

True-Course Guide* automatically guides saw, prevents wood bind.
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MAXAW 777 SAW TABLE

Rugged, all-steel; oversize top, 24" x 20". 34" height. New Cam Lock rip fence and 7" calibrated miter gauge operate from either side of saw blade.

MAXAW 717 POWER SAW

Famous **magic-pivot** gives MAXAW deeper cuts—1⅞" at 45°, 2⅛" at 90° —with 6½" blade. Hardened steel gears: snap-back telescope guard. Lighter, easier to handle.

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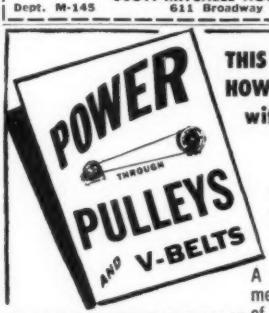

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Enclosed is 25c—please send me the book "POWER Through PULLEYS and V-BELTS"—also contest entry form.

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Perfect for hobby work, gardening, barbecuing. Has three large pockets, adjustable waist and neck bands. Only at your KIMSUL lumber dealer's and only for a limited time.

KIMSUL INSULATION — A PRODUCT OF Kimberly-Clark

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Fuel Injection Is Coming This Year

[Continued from page 272]

pective price down, and began delivering hand-built units to certain car manufacturers for research in mid-1954. Every independent carburetor manufacturer selling to the auto factories has some sort of a fuel-injection system on test.

There are wide variations in fuel-injection design. Racing engines often use a constant-flow or "drool" system. An intermittent system, wherein the fuel is vapored directly into the cylinders through holes in the cylinder walls, is highly successful. It works—but the cost is prohibitive. The injection pump must be big to supply the necessary pressure, and the nozzles must be rugged enough to withstand the high temperatures and pressures in the cylinders.

Cool nozzles. Bosch devised a system with what is known as "port injection." The fuel is vapored into the cylinders from nozzles placed just behind the regular intake valves. It goes in with the air, which is delivered by the intake manifold. The nozzles are cooled by the vaporizing gas and the air. They are not subjected to the heat and pressures in the cylinders.

Fuel-line supply pressures are lower. So the pumps can be smaller and cheaper.

The big problem was fuel-flow control. A diesel engine doesn't care a great deal how much air is rammed into its cylinders. When the fuel comes in and the piston goes up, it fires. But if the proper fuel-air ratio is not maintained in a gasoline engine, says Sidney E. Miller, American Bosch's engineering vice-president, "you're dead."

Bosch wanted a simple, inexpensive control. It was obtained by keying fuel flow to intake-manifold pressure. The accelerator pedal, acting exactly the opposite to that on a diesel, valves only air into the engine. The position of the valves—the same butterflies that you have in your present carburetor—determines the amount of vacuum in the manifold.

Vacuum control. A little pipe taps the manifold. The amount of vacuum

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PALLEY MODEL BARGAINS

NEW 12" ELECT. BOAT KIT 3.95

A genuine electric motor driven speed-boat with an electric spotlight. Wood Hull and Deck are already completed (excepting paint) and are ready for final assembly. Complete Kit includes elect. motor, spotlight, accessories. Works on 2 flash batteries.

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Used by Navy for Gun Control. An ideal emergency communication system because each set is 'sound' powered – no other power needed. Will reach any point-to-point in a radius of 1/2 mile. Each set includes 2 phones on chest plate, 2 headsets, button switches and approx. 35 ft. of wire. PER SET

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Carbon type with push-to-talk button. Ideal for use where background noise is high. Can be operated with 1½V drycell. Comes 6 ft., 3 conductor, shielded cable & plug.

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WITH REMOVABLE WOOL LINER

A cold weather friend. Outer cover is heavy duty mountain cloth – wind and weather resistant. Removable liner is simulated fur. Front has 3/4 length zipper covered by a button down storm flap. Four outside pockets have button-down storm flaps. Parka hood gives complete protection. Sizes: Small, medium and lg. Large size ideal for average woman. A $45.00 value. . . .

45.00 VAL 14.95

NEW 2 IN 1 MECHANICS GLOVES 2.98 PAIR

Actually TWO gloves in one! Outside is durable horsehide with woven wool inner liner. Liner is removable to become second pair. Outer glove is ideal for driving. Sizes: Small, medium and large.

NEW AIR CORPS COLD WEATHER GLOVES 2.98 PR

Genuine Capeskin with fur-fit, knit cuffs and soft flannel inner liner. Made for the Navy Air Corps for use in extreme cold. Handsome Cordovan Brown. Sizes: Medium and Large.

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COMPLETE WITH LEATHER BELT CASE

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FEATURING 60, 120, 150, 180, 300 AND 450 POWER MAGNIFICATION

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6 - All Metal Body – inclines through 90 degrees.
7 - Special Hardwood Case and 3 glass slides.

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Has 10 inch, sturdy leather uppers and a genuine, all rubber shoe with a felt inner sole. Designed to be worn with or without ordinary shoes. Gives complete protection from water, snow, mud, etc. Sizes: 10 and 11.

SHEEPLINED FLIGHT BOOTS 9.95

Full sheepskin lining. Leather uppers & rubber lowers. Double zipper front. Laced up in back. Snug comfortable fit. Soles have heavy NON-SKID tread. In 3 sizes: Small, Medium, Large.

FIRST QUALITY WOOD LEGS WITH BRASS TIPS

BUILD OR RESTYLE YOUR FURNITURE

Now you can build your own modern furniture or re-style old furniture to look like new. These legs are of selected, seasoned wood, beautifully turned and smoothly sanded. They have brushed brass tips and a hidden steel mounting plate. Available unfinished or finished in Blonde, Silver Fox, Mahogany or Charcoal. Please specify when ordering.

Price per set of 4 with brass tips

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18"	5.35	4.75
28"	6.25	5.35

180° OFFSET DRIVE

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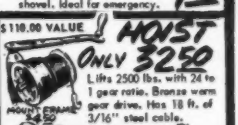

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present shows how much air is being delivered to the cylinders. Minimum vacuum, for instance, indicates wide-open throttle and a lot of air. The pipe transmits the information to the fuel pump, and the pump sends a proportionate amount of fuel to the cylinders.

There were other problems. Priming for cold starts was a stickler. A carburetor primes through an automatic or manual "choke." Bosch finally devised an automatic method for spraying gasoline vapor directly into the manifold.

At this point everything was working perfectly—in the laboratory. But one wintry day a Bosch man threw one of the company's research cars, equipped with an automatic transmission, in gear and promptly killed his injection engine. It primed and started all right, but it balked at the load until it warmed up.

Bosch won't reveal the answer that its engineers found to that one.

"We solved it," says Miller. "Our competitors will have to find out how."

Bosch fuel injection originated in the company laboratories in Springfield, Mass. It now has passed rigorous heat and cold tests: Research cars have been driven in zero weather. Laboratory systems have been run at 60 degrees below.

Fuel-injection systems will require more attention than a carburetor. Some of the parts are machined to tolerances of millionths of an inch. The plunger in the fuel distributing pump will cycle back and forth 10,000 times a minute at a road speed of 60 m.p.h. How will the parts wear? Bosch says that the moving parts should last for 100,000 miles.

Because the fuel flowing through the distributing pump and injection nozzles must be extra clean, the special fuel filter should be replaced at about 30,000 miles.

Engine alterations will accompany the adoption of fuel injection. Present engines are not designed for it. What changes will come about is a guess.

Cylinder heads may undergo reshaping. Intake manifolds certainly will grow bigger. Fuel injection will remove the restrictions on their size. More air will permit more fuel to be fed to engines. More fuel will produce more power.

But the traffic ticket will remain constant amid the changes to come. The other day a friend of Miller's, newly introduced to fuel injection, stepped on the gas when the light turned green. In an excess of ecstasy, he was doing 50 before he knew it. Too late, he spotted the cop.

He paid. END

NEXT MONTH ...

Building 2½ Engines a Minute

IN DETROIT'S newest automobile engine plant, the workers mostly twist dials and watch blinker lights. The heavy work is done by mammoth machines that practically think. Result: a new V-8 every 24 seconds. A single station tests 72 finished engines at a time: connects fuel, oil and water lines . . . starts the engines . . . runs them 20 minutes . . . shuts them off . . . reports how they did.

This latest miracle of automation will be described in five pages of eye-witness sketches by artist-reporter J. George Janes in the March issue of POPULAR SCIENCE MONTHLY.